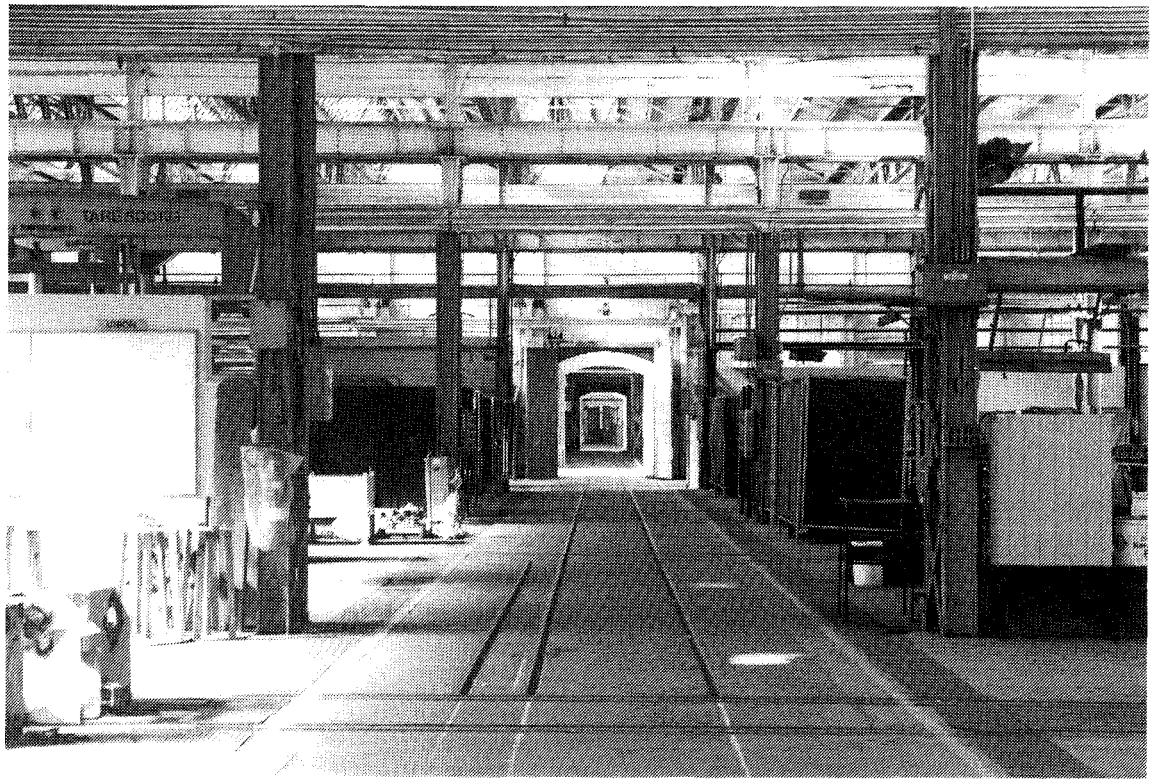
MIDLAND WORKSHOPS



INDUSTRIAL ARCHAEOLOGY STUDY

Volume 1 ~ REPORT

GUIDE TO THE INVENTORY

C & MJ Doring Pty Ltd **1994**

MIDLAND WORKSHOPS

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GUIDE TO THE INVENTORY

Prepared for

CENTRAL MIDLAND PLANNING TASKFORCE

Cover Photograph: Internal north-south trolley tracks (aka crossing), linking Blocks 1, 2 & 3.

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1. INTRODUCTION

1.1 BACKGROUND

The first West Australian Government Railway (WAGR) Workshops was opened at Fremantle in 1886, five years after the Fremantle to Guildford railway was inaugurated as the first metropolitan railway in Western Australia. The Fremantle Workshops site was only 3.5 acres, far too small for the working spaces which would be needed. Just two years after the Fremantle Workshops opened, C.Y.O'Connor was recommending relocation to a larger site. After much political wrangling, the PWD in 1897 began construction of a new railway workshops on a very ample 226 acre site at East Guildford (later called Midland Junction, and now simply Midland).

Progress at Midland was sporadic, and subject to several further reviews and revisions, so that it is difficult to say when the Midland Workshops actually began. However, the clearest date is 1904, when half of the main buildings were erected, and the Fremantle operations and staff were moved to Midland.

According to evidence recorded in the 1902 Parliamentary Select Committee Report on "The Equipment of the Proposed Railway Workshops at Midland Junction" (which mostly discusses the size and cost of buildings), the Midland Workshops were designed and equipped primarily to maintain and repair (steam) locomotives, carriages and wagons. They were also equipped to make wooden-bodied goods wagons (excluding steel under-frames), and with the possibility of making wooden-bodied passenger carriages. Manufacture of locomotives or the steel undercarriage of cars and wagons was not originally envisaged.

Ironworking would be limited to the repair or replacement of corroded locomotive boilers, reconditioning of worn wheels and bearings on locos, carriages or wagons, and replacement of miscellaneous damaged metal fittings on rolling stock. This is reflected in the surviving workshop equipment from 1904 or earlier, which is mostly for woodworking, boilermaking, general blacksmithing or light sheet metalworking.

As time passed, the variety and scope of work grew, and the metalworking and metal machining facilities in particular were expanded. In 1908, complete carriages and wagons were being built at the new Workshops. During World War One some munitions manufacture was undertaken. Locomotives were being built from the ground up by the mid-1920s. By the end of the 1920s the Workshops were self sufficient in most respects, including manufacture of such basic items as nuts, bolts, rivets and dog spikes. This was the result of a deliberate policy, expressed in the Annual Report of 1920 thus:

> "A policy has been established of manufacturing within our shops numbers of articles which have hitherto been purchased from outside the State. It is considered that this will not only be economical but will have the advantage of keeping expenditure within Western Australia, ..."

1. INTRODUCTION

1.1 BACKGROUND (Continued)

During the 1930s and 1940s, Midland Workshops went through phases of contraction and expansion similar to those experienced in other major Australian engineering establishments. The Depression saw the budget and workload reduced and the workforce heavily cut - more heavily than in the NSW railway and tramway workshops which adopted a policy of Work Rationing, where most employees were retained, but working reduced hours for reduced pay.

The onset of World War Two initially reduced staff at Midland Workshops as men volunteered for war service, but this was offset by the addition of War Effort work (eg. manufacture of munitions and marine engines) and the recruitment of additional temporary employees, including women. This period has left a legacy of wartime buildings and plant, notably machines for precision toolmaking and precision measurement needed to meet the demanding quality control requirements of munitions manufacture.

Following the War, Midland Workshops (and others) underwent a flurry of equipment renewal, as part of the Federally subsidised Post War Reconstruction programme. At about the same time, the Perth electric power supply changed from 40 to 50 cycles per second, prompting the replacement of some old machines driven by 40 Hz motors, the fitting of small individual 50 Hz motors to other machines previously driven by overhead lineshaft powered by large shared 40 Hz motors, and removal of the lineshafting. These two factors resulted in a major rearrangement of the Workshops to accommodate the new machines, and to take advantage of the freedom of layout permitted by the change from regimented lineshaft power transmission to more flexible electric cable power supply.

A large proportion of the surviving Workshops plant dates from the 1940s and 1950s, which is significant in representing a period of major change in the capacity and precision of the Midland Workshops, and the Australian engineering industry in general.

Since World War Two there have been several technological changes which have had a major impact on Workshops activities and equipment. Steam locomotives have been replaced by diesel locos, resulting in a drastic reduction in boilermaking activities, and the establishment of extensive facilities for repair of large diesel engines. Wooden-bodies on carriages and wagons have given way to steel bodies, and more recently aluminium bodies. Electric welding has replaced riveting as the main means of joining heavy steel components, and oxy-cutting has largely replaced the traditional mechanical or manual methods of cutting shapes from steel plate prior to joining. Computers have taken over many routine clerical tasks, and now control some machine tools as well. Some of these changes are represented in the inventory of heritage plant, but others have been too recent for the related plant to yet be classed as heritage items.

1. INTRODUCTION

1.1 BACKGROUND (Continued)

Recently there have been two major changes in managerial and/or political direction which have impacted heavily on the operation, staffing and equipment of the Workshops, and on its heritage value. The first change began in 1991, when the Workshops embarked on a Quality Assurance programme in response to a joint Commonwealth/State policy that required Q.A. certification of all suppliers of goods and services to governments. The W.A.G.R.'s own Midland Workshops required Q.A. accreditation as supplier to the railways and other government instrumentalities. The Workshops' Q.A. accreditation process was supervised by Lloyds Register, and among other things involved the scrapping of large numbers of old machines, dies etc, many undoubtedly of heritage value. The final Q.A. Audit inspection of work practices and procedures took place during 19th - 22nd April 1993, and Q.A. Accreditation was granted later that month.

Ironically, just after the long, expensive and, in heritage terms, damaging Q.A. Accreditation programme was completed, the W.A. Government announced on 28th April 1993 that the Midland Workshops was to be closed in March 1994. Obviously, this decision has had the greatest impact of all, after the decision to establish the Workshops. From the heritage viewpoint, the closure has changed the Workshops from an almost unique integral operating unit to a less integrated non-operating one. Many files and similar documents have been destroyed. People with memories of the Workshops' operations have been redeployed elsewhere, or laid off as redundant. Much equipment has already been dispersed to other parts of the railways, or sold or scrapped. Some of the equipment of heritage value so far retained is in danger of being sold or leased to other operators due to short term operational needs, and so dispersed from the Midlands site. Some is in danger of being vandalised or simply rusting in situ. These changes have detracted from the heritage significance of the Workshops and remaining plant, although the overall heritage significance of the Workshops is still very high.

1. INTRODUCTION

1.2 THE INDUSTRIAL ARCHAEOLOGY STUDY

After announcing that the Midland Railway Workshops would close in March 1994, the State Government set up the Central Midland Planning Taskforce - including representatives of Westrail, the Department of Planning and Urban Development (D.P.U.D) the Department of Commerce and Trade, the local Shire Council, and the local Chamber of Commerce - to supervise planning of the future use of the Workshops site.

Using funds provided mainly by Westrail and D.P.U.D., the Taskforce commissioned a consultant team headed by K.A. Adam & Associates (Planners), to prepare an overall Strategy Plan for the future use of the site, taking into account five main aims, including retention of the heritage value of the site.

This Industrial Archaeological Report was prepared by C & MJ Doring Pty Ltd, as a component of the Strategy Plan, and is concerned primarily with an inventory of operational Workshops equipment and other Workshops artefacts considered to have high heritage significance and interpretative value. That is, the artefacts have the ability to be used, in a museum or similar context, to demonstrate and explain to the public, the history, operation and heritage significance of the Workshops.

This Industrial Archaeological Report was prepared in conjunction with, but separate from, a Conservation Policy for the Workshops buildings and other site features, prepared by the firm Heritage and Conservation Professionals (HCP) as another component of the Strategy Plan.

1. INTRODUCTION

1.3 METHODOLOGY OF THE STUDY

The assessment of cultural (heritage) significance of the workshops plant and artefacts, and the formulation of recommendations (or conservation policy) for the more significant items, was carried out broadly in accordance with the philosophy and principles laid out in the Burra Charter of Australia ICOMOS, and as amplified in "The Conservation Plan" written by J.S. Kerr (published by National Trust, NSW). Various constraints have led to some modifications of the methodology proposed in "The Conservation Plan". These are set out in sections 1.5 and 1.9 of this Introduction.

The primary aim of this study was to identify heritage items and historic artefacts among the existing plant and machinery at Midland. The background history of the Workshops and assessment of the Buildings is covered in The Heritage Professional's Report. We have based the Inventory on direct visual inspection of existing plant, backed up by reference to Plant Cards, Workshops drawings, Annual Reports and similar documents and verbal advice from Workshops staff. Our assessments are based largely on our knowledge of and comparisons with other Railway Workshops and industrial sites in Australia and overseas.

1.4 PERSONNEL

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1. INTRODUCTION

1.5 CONSTRAINTS ON THIS STUDY & ITS RECOMMENDATIONS

Months before this Study was commissioned, the Government had already decided not to allow the Midland Workshops to continue to operate under WAGR control, and not to allow any private contractors to operate all or part of the Workshops, (although these appear to be the best options for conservation of the heritage values of the Workshops and for promotion of employment opportunities in the Midland area - two of the stated aims of the Study). The authors of this Report still consider these to be the most appropriate options for future use of the Workshops, and feel duty-bound to recommend them as such, even though these recommendations are not likely to be accepted at present.

In the few years before closure was announced, much equipment of heritage interest was removed from the Workshops (eg most wheel lathes, and many blacksmithing tools). This was done partly in preparation for a major equipment upgrading which did not eventuate, and partly to meet requirements of the 1991-93 Quality Assurance Audit process. The April 1993 decision to close the Workshops caused further removal of plant and restriction of activities.

By late 1993, when this study commenced, Workshop activities were already heavily curtailed, and most employees had been transferred elsewhere or made redundant. Modern usable plant was transferred to other parts of Westrail. Many plant items, particularly older ones, had already been taken to Salvage for sale as scrap, and/or had been sold or broken up. Many plant items still on site were being got ready for disposal, by having their WAGR number-plates removed, thus making it difficult to positively identify some machines.

In some cases our research was hampered by the removal from the files (and presumably the destruction) of any records of decommissioned machinery. For instance an old drawing showed a plant item No. 274 in the location of the Gap Riveter. The plant card for this item apparently no longer exists, so details of the Gap Riveter (if it was so) could not be verified.

Prior to being engaged, we were not permitted to inspect the Workshops, but were given to understand that there were approximately 50-100 plant items to be investigated as being potentially of significance. In fact, we inspected about 2000 items of equipment, and identified about 600 of them as significant individual items, some major, some minor, falling into about 30 trade or functional Groups. To cope with this large number of items we have had to restrict the Inventory (in Volumes 2 and 3) to one page for each individual item, with a brief description and discussion, and (usually) a photograph. In most cases, the assessment of significance and the recommendations for individual items in the Inventory are of a brief standardised nature. Fuller discussion of the significance of and recommendations for the various Groups, is given in this introductory Volume 1.

1. INTRODUCTION

1.6 PLANT INVENTORY AND PLANT NUMBERS

The Plant Inventory is contained in Volumes 2 & 3 of this Report, set out in order of plant number. The first section of the Inventory (in Volume 2) covers Plant Numbers up to 3000, starting with plant item No.46, a Kendall & Gent Pipe Cutting Machine, made specifically for the West Australian Government Railways in Manchester in 1904. The second section (Volume 3) includes plant items with numbers over 3000, plus 261 items in the arbitrary plant number series 8000.

Except for the 8000 series, the plant numbers used in the Inventory are actual W.A.G.R. Plant Numbers as shown on oval metal plates attached to the machines, and as shown on the corresponding Plant Cards held at the Workshops. The W.A.G.R. Plant Numbers under 1000 are all fairly old machines, but not numbered in any date order. Plant Numbers in the 1000 to 3000 series tend to be newer machines, numbered in approximate date order, but with occasional old machines included out of date sequence.

Series 8000 plant numbers are arbitrary numbers assigned by us for the purpose of this Inventory, to cover items for which official plant numbers did not exist or could not be identified. The 8000 series includes a few substantial items of machinery for which a plant number probably exists but could not be found (eg. an unlabelled pneumatic sump pump called here Plant No.8033), and several cranes and furnaces which had their own separate numbering systems, independent of and incompatible with the W.A.G.R. Plant Card numbering system. The 8000 series also covers a large number of items (small tools, anvils, vyces, trolleys, rail lines, furniture, tanks, pipelines, Workshops' products etc.) which by their nature are unlikely to have been accorded regular plant numbers, but which nevertheless were an essential part of the operation of the Workshops or are important to the interpretation of the Workshop's history.

Some of the Inventory entries such as the rolled drawings seen in the Foundry (No.8233), or the remnants of high pressure water pipeline (No.8185) for the once extensive water hydraulics, or the various articles of Blacksmith's traditional hand tools (No.8013) are not meant to be an exhaustive catalogue of those particular types of items, but are a sampling of the surviving artefacts. The recommendations accompanying these entries are intended as a guide to the treatment of the listed artefacts and of similar artefacts found elsewhere on site.

To assist readers to find particular items in the Inventory, several summarised lists of the items are given in Volume 1, sorted by Group classification (eg. Woodworking, Blacksmith, Hydraulics etc.), by Plant Number and by Location, as discussed below.

1. INTRODUCTION

1.7 PLANT GROUPS

All items in the Inventory have been assigned to a particular (main) Group, indicated by a two-letter code. Each group is associated with a trade, task, service, or class of machine at the Workshops (such as Blacksmithing, Mechanical Handling, Wheel Shop, Tool Room, Boilermaking, Foundry work, Plant Maintenance, Woodworking, Hydraulic Power, etc.). Additional Groups for which relevant artefacts have been listed include Administration, Staff Amenities, Building Details, Furniture, and Site Features other than buildings.

Where appropriate, some items also have an associated (secondary) Group identification. For example, the hydraulically powered flanging press No.2006 is listed under Group BO - Boilermaking as its primary group, but also under Group HY - Hydraulic Power, as a secondary or associated identification. It has not been listed in the inventory under the secondary heading, but the discussion in the section on hydraulic equipment applies to the press as well as to its associated pump.

A list of the two-letter Group codes and Group names, together with explanatory notes on the scope of the Groups, will be found in all three volumes of this study.

1.8 PLANT LOCATION IDENTIFICATION

The present location (as at December 1993) of every item in the Inventory is given by a Site Number code, covering buildings and areas on and off the Workshops site. This code is based on a 1-74 number code originally developed for the architectural study, but which we understand is no longer used in that study. That code was extended by us to cover additional site features and buildings (Nos.81 to 99) not included in the original architectural list. The extended two-digit Site Number code has been used by us for computer listing and sorting of photographic subjects, as well as for identifying the location of items in the Plant Inventory. The Site Number Code starts at No.1 (the C.M.E.'s Office) and finishes at No.99 (General Groups of several Workshop Buildings or Site Features). Location Numbers 75-80 were not used.

As well as a Site Number, the Inventory gives the name of the present location, and often gives some additional details to assist the location of the items within large buildings. Many items of plant have been relocated during their operating life, and (where known) information is also given about definite or probable earlier locations of the plant.

A listing of the location codes, with an explanation of the scope of each number, will be found in all volumes of this study.

1. INTRODUCTION

1.9 LEVELS OF SIGNIFICANCE OF INVENTORY ITEMS

A general Statement of Significance for the collection is given in Section 2. In many respects, this statement is associated with the significance of the buildings which house the collection. More detailed Statements for the various groups of machinery and artefacts head the Inventory Summaries for each Group.

It was not possible to write individual Statements of Significance for every plant item or artefact included in the inventory. Particular aspects of the significance of a few items stood out, and have been noted in the description. This applied to such qualities as age (eg. 19th Century), or length of time in service (eg. moved from Fremantle), a famous maker (eg. Robinson of Rochdale), or the intactness of machines which survive complete with accessories.

Many assessments are made relative to the existence of equivalent plant and machinery in other historic workshops, in Australia or overseas. Where rarity is a feature of a particular machine this has sometimes been noted on the inventory sheet. More often it is implicit in the overall assessment of the Group to which the machine belongs (eg. the Wheel Shop equipment).

Significance of each item in the Inventory is assessed on two bases, that of the individual item considered as a stand-alone artefact, and that of the item's contribution to the significance of the Group to which it belongs. For instance the Hitachi Wheel Lathe (No.3106) is modern, and is rated individually as being of moderate significance. However, it is the only wheel lathe in the Wheel Shop, and is essential for the integrity and operability of the rest of the Wheel Shop. Thus its Group Significance is rated as Very High.

The significance level of each item in the Plant Inventory is noted as being of Very High Significance (A), High Significance (B), or Moderate Significance (C). These levels apply to both individual and group contributions. Items of Little Significance (D), or Intrusive items which detract from the significance of the collection (E), have not been included in this Inventory. These significance levels are compatible with the A, B, C, D & E levels used in the Heritage Professionals' Conservation Policy, and are based on the significance levels relevant to nominations for entry into the W.A. Register of Heritage Places.

We have tried to compile the Plant Inventory as thoroughly as possible within the constraints of time, money and resources allocated to this study, however, the Inventory should not be taken as being immutable. Considering the limited time that could be spent individually researching and evaluating each of the many hundreds of items which had to be assessed for inclusion in (or exclusion from) the Inventory, it is possible that additional information will come to light which will warrant changing the assessment of some items, either up or down, or will necessitate altering the descriptions given in the Inventory. Given the huge number of items of plant in the Workshops, the vast area of the Workshops buildings and yard, and the many hidden nooks and locked cupboards, it is also quite possible that some important items have been overlooked altogether, and will need to be added to the Inventory at a later date.

1. INTRODUCTION

1.10 RECOMMENDATIONS & CONSERVATION POLICY FOR INVENTORY ITEMS

A general statement of Recommendations and proposed Conservation Policy for the Midland Workshops collection of heritage plant, as a whole, will be found at the beginning of Volume 1 of this Report. More particular proposals for each Group of machinery or artefacts are given in the preambles to the Inventory Group Summaries, also in Volume 1.

Recommendations for individual items in the inventory are formalised and compressed into two lines for each item, appearing near the bottom of the Inventory sheets given in Volumes 2 and 3. One line recommends a proposed future use of the machine or artefact (eg. working museum, static display etc.). The other line advises whether the machine or artefact should be kept in situ, or moved to another part of the site.

1.11 PHOTOGRAPHS

Photographs used in the Inventory, and on the covers of the three volumes of this Study, have been selected from several thousand colour and black-and-white photographs taken at the Workshops by C.& M.J.Doring Pty Ltd in 1993. The negative numbers given on the Inventory sheets refer to the catalogue of negatives of C.& M.J.Doring Pty Ltd, held in Sydney. If two negative numbers appear on an inventory sheet (ie. both colour & black-and-white) these are matching photographs taken from exactly the same viewpoint, and either the colour or the black-and-white print may have been used in the Study Report.

1.12 ACKNOWLEDGEMENTS

We wish to acknowledge the help given to us by staff at the Battye Library and the Westrail Library. Members of the Australian Railway Historical Society have been most helpful. At Midland Workshops, our study would not have been possible without the help and co-operation of the Staff. Hugh Smith, Les Robinson, Jack Greenway, Alan Brown, Greg Perejuan, Dick Stubberfield, Mick White, Bill Bibby and Merv the Boilermaker were among the many tradesmen and staff-members who went out of their way to show us around and tell us about their work at Midland.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

There is no doubt that the Midland Workshops has high local and State heritage significance. The Workshops was one of the largest (if not the largest) of engineering establishments in Western Australia. It was essential to the operation of the Western Australian Railways for most of this century, and hence played a vital role in the economy, development and daily life of Western Australia. This heritage is embodied in the documentary records, in the memories of the people who worked there, in the rolling stock and per-way works produced or repaired there, and in the surviving plant and buildings.

For a general statement of the significance of Midland Workshops, the reader is referred to Section 4 of the Midland Railway Workshops Site Conservation Policy prepared by Heritage & Conservation Professionals. The assessment in this report is concerned more with the Workshops as an operational entity, and particularly with the extensive collection of machinery and other artefacts contained in the Workshops. The significance of the Workshops equipment is discussed as a whole, then as belonging to the various Groups, and finally (in Volumes 2 & 3) as individual items. This inevitably involves some repetition.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.1 HISTORIC SIGNIFICANCE

The substantial nature of the 1904-12 buildings and complex, and the high quality of the surviving early machinery, signifies the importance of the role of the Workshops to the Western Australian Government Railways and to the State.

The early expansion of the half-sized 1904 Block 1, 2 & 3 buildings to their originally planned size, and the ability of those buildings to continue in their originally planned basic functions for 90 years with little further modification, signifies the far-sightedness and competence of the original planners. It also demonstrates the victory of those favouring a policy of planning and building for long-term durability and viability, over those proposing smaller and cheaper buildings which would have saved initial outlay but would have had to be rebuilt many years ago.

The expansion in capability of the Workshops from simple maintenance of rolling stock to the ability to manufacture complete carriages, wagons and locomotives, and to locally manufacture all or most of the Railways requirements in terms of castings, nuts, bolts, rivets and dog spikes, etc., represents the growth in Western Australian engineering expertise and self-sufficiency.

The buildings and plant surviving from the World War Two manufacture of munitions, marine engines etc., signify the major contribution made by Midland (and similar) Workshops to Australia's defence in time of need, and the value in maintaining a basic infrastructure of local engineering equipment and skills to cope with future periods of conflict or other disruption to international and interstate trade. Surviving World War Two machine tools and measuring equipment (some still bearing "Ministry of Munitions" nameplates) also represent a major advance in the variety and precision of the Workshops' machine shop and metrology capabilities.

(There is some mention in annual reports of the Workshops being involved in munitions manufacture in World War One, but no details of this were found.)

Dual-gauge tracks in the Workshop area, dual-gauge inspection pits in Block 3, and enlarged rolling stock access doorways in several Workshops buildings, represent the arrival of Australian Standard Gauge rolling stock in the 1960s, when Western Australia was linked by Standard Gauge to the eastern states.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.2 SCIENTIFIC/TECHNOLOGICAL SIGNIFICANCE

Midland Workshops represents an early Australian example of a major engineering complex designed to be powered by electric motors (via lineshafts) and equipped with overhead travelling electric cranes.

The structural design of the Workshops main buildings reflects the functional needs of a railway workshops; long wide-span bays with overhead cranes travelling end-to-end, able to lift heavy components or rolling stock; a network of tracks inside and outside buildings, allowing rolling stock and components to move from building to building, or process to process, as needed, and to transfer between the Workshops network and the main state rail system.

The riveted lattice-style structural steel columns in Blocks 1, 2 & 3 represent a very successful transition from traditional cast-iron column technology (as in the 1880s Eveleigh and Newport buildings) to the then new rolled steel section technology, with the structure performing satisfactorily for 90 years so far (and with many years life left yet). The c1902 PWD column design is very similar to designs being used for crane-bearing steel columns in other workshops built 20 or 30 years later (eg the 1927 Newport Workshops buildings).

Midland Workshops has a group of water-hydraulic machines which produced a supply of high-pressure water, and other machines which used the water pressure to generate large forces for bending or pressing metal into required shapes. The various water-hydraulic machines are almost certainly the best and only operating group of such machines left in Australia, and have very high significance in representing this once very important and now almost vanished technology. The machines also demonstrate the evolution of water-hydraulic technology from c1904 to c1954. The later machines offer stiking evidence that the technology was still considered viable for newly built heavy presses up to the 1950s, and can still be viable in operation today.

(In fact water-hydraulics is regaining favour overseas, as preferable to the more modern oil hydraulics on both environmental and fire safety grounds.)

The Metrology Room collection represents state-of-the-art precision measurement technology of c1940-50s. This major collection of imperial (inch) measuring instruments was once standard but is now rare in Australia's metricated industry.

The Blacksmith Shop has what is possibly Australia's best surviving operable group of old steam-hammers, and of both steam and electric-powered drop hammers (together with dies). The Blacksmith Shop also has a comprehensive 1950s spring-forming shop, and the last operating dog-spike line in Australia. The surviving collection of traditional manual blacksmithing tools is meagre and not the best in Australia, but is still sufficient to demonstrate and represent the art, and to complement the outstanding group of mechanical blacksmithing tools.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.3 SCIENTIFIC/TECHNOLOGICAL SIGNIFICANCE (Continued)

The Wood Mill (woodworking shop), has what is probably Australia's best and most comprehensive group of woodworking machinery representing state-of-the-art wood working technology from c1890s to c1950s. The associated Patternmaking Shop equipment and Saw Doctor's tools also have significance as unusually comprehensive and high quality examples of their type, although more modern (mostly dating from 1950s.

The Machine Shop (including the Toolroom) holds one of Australia's largest and most comprehensive group of machine tools representing best metal-machining practice from 1920s to 1980s. It is significant as a group, but also has some very highly significant individual machine tools, including probably the largest crankshaft-grinding machine in Australia, and several large machine tools made in Australia, which demonstrate the capability of Australian industry to make such tools when necessary.

The Foundry has probably the oldest operating electric arc furnaces in Australia, and unusually old cupolas, representing state-of-the-art iron and steel foundry technology of the 1940s and 1950s. It also has a set of old but still working moulding machines, representing the best of 1930s mould-making techniques.

The Boilermaking and Flanging Shops have a fairly comprehensive collection of heavy machines for forming steel plate into shapes to make boilers or similar structures. These machines include a rare plate-edge planing machine custom-made for WAGR in 1902. Unfortunately, little of the specialised equipment for riveting boilerplate survives, but there is still enough to demonstrate and represent that important but now vanished technology.

The Coppersmiths (and Tinsmiths) Shop has an unusually comprehensive and extensive collection of traditional manual sheet metal working tools, many dating back to the 1890s. The tools are still operable and very suitable for demonstration.

The Powerhouse no longer holds power generating equipment, but does hold a group of old air compressors, air pumps, water pumps, etc., ranging from c1904 to c1940s, which must be one of Australia's most outstanding and visually appealing collections of such equipment.

Surviving early items of Test House and Laboratory equipment demonstrate the scientific approach to railway engineering which has been applied at the Workshops since its inception.

Oerlikon electric overhead travelling cranes in the Boiler Shop and Stores, and the partially dismantled crane in the Powerhouse, all installed c1904, would be among the first and oldest surviving electric cranes in Australia.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.4 SOCIAL SIGNIFICANCE

The Personnel Dockets (individually numbered metal discs), and the associated docket boards with hooks which are located at the entrance gates and in the various Shops, are evocative of the thousands of employees who worked in the Workshops over the last 90 years. As seen in 1993, the small number of round discs (representing current employees) and the huge number of square tags (representing employees dismissed or resigned) is stark evidence of the decline and eventual closure of the Workshops.

The original elevated Foreman's Offices which looked down on the workshop areas, as found in several of the c1904-12 buildings, and the later floor-level foreman's offices, demonstrate a change in the relationship between supervisors and workmen during this century.

The First World War memorials, including the individualistic memorials dedicated to men who enlisted from various Shops and offices (Boiler Shop, Stores, etc.) are a poignant reminder of the almost naive patriotism of the day, and of the way the members of each trade Shop or administrative group considered themselves as a separate community within the Workshops.

The Second World War equipment, and wartime buildings and amenities, are reminders of the social changes brought by the Second World War, by the exodus of workshops men to serve in the armed forces, and in this case by a corresponding influx of non-railways staff (especially women) to the Railway Workshops.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.5 RARITY

There are several equivalent or older railway workshop building complexes in Australia, UK and USA, but Midland is the only railway workshops complex of its age and scale known to be still equipped with historic machinery and operating in any of those countries, as at 1993 (or operable, after March 1994).

Midland Workshops contains a number of individual machines, or groups of machines, which are now very rare, or in some cases are unique in Australia. Examples include:

Locomotive weighbridge (No. 545)

Operable 1902/1904 electric cranes (Nos. 8020 & 8102)

Operating high pressure water-hydraulic system, with pump (No. 585), accumulator (No. 2076), various hydraulic presses (Nos. 2006, 1005, 251) and interconnecting pipework No. 8185).

Large Churchill crankshaft grinder (No. 2267)

Operating dog spike line (various numbers)

Two operating 1940s electric foundry furnaces, for melting steel (Nos. 1315 & 1316)

Buckton chain testing machine (No. 456)

Collection of 1890s coppersmiths tools (various numbers)

Steam-operated drop hammer (No. 238)

Operating arch (Nasmyth-style) steam hammer (No. 226)

Tower drill (for making riveted boilers) (No. 1083)

Electric rivet heater (No. 1497)

Collection of turn-of-the-Century Wood Working machines (eg. Nos. 323 325, 327, 329, 352, 343)

2.6 AESTHETIC SIGNIFICANCE

The machinery demonstrates and represents the evolution of industrial design styles over a period of nearly 100 years. Some of the machines have considerable aesthetic impact and appeal - eg. the Sentinel compressors, the Worthington pumps, the Fielding & Pratt press, and the whole Power House group of machines.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.7 COMPARATIVE SIGNIFICANCE

Within Australia, and in most countries, railway workshops have traditionally been the largest and most important engineering workshops of the late 19th and early 20th century. They invariably represented the state-of-the-art in engineering technology in their day. In industrial heritage terms, railway workshops have been particularly important because they encompassed a wide variety of engineering technology and skills, and because the slow rate of change in basic railway technology allowed the workshops to retain and use the same machinery for many years - much longer than in general industry. Furthermore, most major railways and their workshops have been government owned, or have been taken over by governments, and so have had continuity of operation over periods of typically 80 to 100 years, whereas most private engineering establishments will have closed and been disbanded long before that age is reached.

Unfortunately, from the heritage viewpoint, the recent policy change in many countries towards privatisation of railways, or at least railway workshop services, has led to the widespread closure of these old workshops and the scrapping of their equipment. In UK and USA all major historical railway workshops have been closed or privatised, and have been stripped of historic equipment. In Australia, the major workshops at Eveleigh in Sydney and Honeysuckle and Cardiff (Newcastle) in NSW and the 19th Century part of Newport Workshops in Victoria have all been closed and stripped. Some parts of Ipswich Workshops in Queensland are still operating, but it is uncertain whether any historic machinery survives or is operable. This has left Midland Workshops in Western Australia as the only historic railway workshops surviving in Australia with much of its historic machinery and systems intact and operable. Midland is more intact than any comparable workshops in the UK or USA.

Midland Workshops is believed to be the largest, most comprehensive and most historically significant general engineering workshop of any type, still operating in Australia as at 1993. The railway workshops at Ipswich in Queensland is older, but is understood to be smaller and less comprehensive, and is about to be closed. Eveleigh Workshops in New South Wales and the 1888 part of Newport Workshops in Victoria have been closed and have been almost entirely stripped, although they still have a few major items of historic plant, now inoperable. Cockatoo Island naval dockyard in Sydney Harbour has been closed and stripped. Williamstown Dockyard in Melbourne has been thoroughly modernised except for its huge graving dock.

Even when closed, Midland will have the most comprehensive and historically significant collection of operating or operable engineering workshops plant in Australia. Midland has outstanding collections of equipment in each of the main metalworking and woodworking trades, representing state-of-the-art technology from early to mid 20th century (with some dating back to late 19th century). No other workshop in Australia has anything approaching the range and significance of Midland's collection of machinery as a whole.

2. ASSESSMENT OF THE SIGNIFICANCE OF THE WORKSHOPS & PLANT

2.7 COMPARATIVE SIGNIFICANCE (Continued)

Midland Workshops is also significant internationally, at least in the English speaking world, since both UK and USA have closed and/or privatised and stripped all their major railway workshops of equivalent age. Crewe and Derby Workshops in UK are still operating, under private control, but they use modern equipment housed in 19th and early 20th century railway workshop buildings. USA still has one small 19th century workshop from a minor private railway, but all major old railway workshops of equivalent size to Midland have been stripped. (We were advised by the Curator of Mechanical Engineering at the Smithsonian in Washington DC, that one old railway workshop building in USA which had been stripped is now gradually being re-equipped with unrelated machines gathered from elsewhere, in an attempt to recreate an historical workshop museum exhibit. This will inevitably be less comprehensive and a lot less authentic than the collection already existing at Midland.)

While Midland Workshops has a fine set of industrial buildings and some outstanding individual items of plant, it is of national and even international significance primarily in that it holds what is W.A.'s and almost certainly Australia's most comprehensive collection of historic workshops machinery and plant. Midland's collection covers all major traditional workshop trades, it spans the period from late 19th to mid 20th century, and up to the present day, and the equipment (except for the Wheel Shop) is almost all complete and in working order. In a few instances, other workshops in Australia may have a group of equipment representing an individual trade which is equal to or even better than the corresponding Midland trade group, but to our knowledge there is no other workshop complex in Australia approaching the comprehensiveness and significance of Midland's collection of equipment representing a multiplicity of traditional engineering trades.

Consequently, it is important to plan the future conservation and management of the Workshops equipment in terms of groups, rather than individual items, and to keep each group together as an integral whole rather than dispersing the items to separate locations.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.1 OPTION FOR CLOSING WORKSHOPS & EMPTYING BUILDINGS

Eveleigh Locomotive Workshops, Newport (1888) Workshops, Honeysuckle Workshops, and the Crewe and Derby Railway Workshops (UK), have all been "conserved" to the extent that their buildings are still standing, but have been stripped of all or most of their historic equipment. Crewe and Derby are still operating as railway workshops, but with new equipment. The others are non-operational.

Midland gains a lot of its significance relative to these other major railway workshops in that it was still operating (as at 1993), and is still operable (1994), and that it has a great deal of its historic equipment still in situ and in working order. Within the English-speaking world, Midland and Ipswich Workshops appear to be the last of the large early railway workshops in anything like original working order.

The option of removing all equipment from Midland and just keeping the buildings, would destroy a large part of Midland's heritage significance, and would reduce Midland from being a railway workshop of national or international significance, to being a group of buildings of only state significance.

While the more modern Midland machinery could probably be used elsewhere, it is unlikely that much if any of the historic equipment removed from Midland would be re-erected elsewhere for display or use. Re-erection and re-commissioning of the larger machines would be expensive, and would not be undertaken unless there is good reason and ample finance to carry it out. Instead, it is likely that most of the older equipment would simply be sold for scrap.

Obviously, we could not recommend this option. If there is no positive commitment to conserving the buildings and equipment, it would be preferable to simply "mothball" them and keep them in their present state, until a viable future use option is agreed on. Money should not be spent to remove the equipment, thus cutting off future re-use options.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.2 OPTION TO CONTINUE AS RAILWAY WORKSHOPS

It is obvious that there is one option for the future of the Workshops which is the most appropriate from the viewpoints of conserving the heritage value of the Workshops, of finding a suitable use for the buildings, and of retaining local jobs, and that is to continue using the site as a railway workshops. This option would conserve the heritage value and integrity of the buildings and plant, would conserve many local jobs, and would be the best-fit use for the site, for the existing buildings, and for the existing plant.

The Workshops could be run under the present government management (but with improvements in efficiency), or by transfer to private management as has been done at the historic British Rail workshops at Crewe and Derby in England. There the 19th century workshops buildings, with modern equipment, are still successfully used as railway workshops, doing contract maintenance work for British Rail and building new rolling stock and locomotives, under management of a private company BREL Ltd, which is owned 20% by British Rail and 80% by ASEA Brown Boveri.

Even if privately managed, continued Government ownership of the Midland Workshops site would be the best from the heritage viewpoint, to ensure sympathetic future use and maintenance of the buildings and plant. Transfer of the Workshops to private ownership would need very strict long-term controls and supervision, if the heritage values are to be protected.

This option would also retain an essential railway maintenance facility without the disruption and cost of private companies building and equipping new workshops elsewhere. Note that if Midland Workshops are closed, then new railway workshop facilities will have to be built in duplicate or triplicate by several private companies, if the government is going to get the advantages of competition and avoid becoming hostage to a sole supplier. (This comment applies in relation to the establishment of private railway workshops as a whole, or to private undertaking of specialised parts of workshop activities, eg. the essential routine reconditioning of railway wheels and axles.)

If the Contined Use Option was adopted, the remaining heritage equipment would mostly continue in routine use. Equipment modifications or disposal to meet ongoing operational needs would be subject to review of the impact on heritage significance, but this is not likely to impose any great penalty on cost and efficiency. If the old equipment was considered not feasible for commercial use, it could be replaced by newer eqipment, but with the old plant left in situ (or at least on site) for static display, eg. for educational purposes.

We realise that before this study was commissioned, the government had already ruled out this option of continued operation of all or part of the Workshops under either government or private management. Nevertheless, we still recommend this as the most suitable option, to best meet the study's heritage and employment aims, and we urge the government to reconsider its decision in the light of the recommendations of the study it commissioned.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.3 OPTIONS FOR NON-RAILWAY COMMERCIAL USE

Although the Workshops was equipped for maintenance of railway rolling stock, most of the equipment is of a general engineering nature capable of carrying out contract jobbing work for manufacturing, mining, agricultural and transport industries, or suitable for lease to companies working in those industries. For example, the 1000 ton hydraulic press could make satellite and microwave communication dishes; the drop hammers could make spanners, gardening and agricultural tools, automotive components; the Test House could carry out routine physical testing for other industries; The Pattern Shop could make patterns commercially; the substantial grit blasting and spray painting facility could continue to be used for painting government or private rolling stock, or refurbishing shipping containers etc.; and so on.

It should be feasible to lease parts of the Workshops buildings, including both heritage plant and more modern plant, to commercial operators, provided there are adequate controls against damaging the heritage plant and buildings. Probably such an arrangement would allow the equipment to still be used to carry out contract railway maintenance work for the government or for mining and timber companies. However normal leasing might preclude public access to heritage plant in private control, for reasons of commercial sensitivity.

Apart from a wide range of engineering equipment, the Workshops has a mixture industrial buildings, including large buildings with cranes, heavy floors, long tall column-free spaces, and rail and road access, which could suit a range of enterprises. The large buildings offer many possible commercial uses with little adaptation work needed, eg: factories; warehouses; exhibition halls; trucking depot or bus depot; assembly and/or repair of trucks & buses, agricultural machinery or mining machinery; assembly, testing or storage of power generation and transmission equipment; manufacture, storage or retail display of bulky furniture, caravans, etc.; manufacture of large prefabricated building components such as timber or steel roof trusses, modular curtain wall panels, general steel fabrications, airconditioning ductwork, etc. The smaller buildings have almost unlimited potential industrial or commercial uses.

It should be possible to divide the site into a number of separate leasehold areas, for lease to separate enterprises, as it is unlikely that one enterprise would want to lease the lot. Commercial or industrial use of the buildings should be done in a way which respects the heritage value of the buildings (and plant if leased), and of the overall Workshops complex. The government could also consider offering the buildings at attractive short-term lease to companies wanting to test the local market with some new product or service, before committing themselves to buying their own site and buildings.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.4 OPTIONS FOR GOVERNMENT USE (other than railway workshops)

The state government still owns Midland Workshops, and one obvious option is to find other government uses for them. Possibilities to be considered could include: relocating government department offices, depots or stores to Midland; leasing to the Commonwealth for depots or stores (eg. Defence, Telecom or National Rail); leasing to the local council, for depot or offices.

3.5 OPTIONS FOR MUSEUM USE

An excellent option for future use of the heritage plant to be retained, would be to convert all or part of the Midland Workshops into a Working Museum of industrial engineering technology, to demonstrate the nature and recent history of engineering industry, the range of engineering workshops facilities needed behind the scenes to keep the trains operating, and the industrial working life of previous generations. Such a museum would be aimed at attracting local adults, schoolchildren, technical students, and tourists.

In order to make such working demonstration effective, it will be necessary to retain not only the main heritage machines, but also any adjusting tools, dies, gauges, mechanical handling equipment, workbenches etc., needed to operate them. It might also be necessary to retain some associated non-heritage machines, which are needed to form viable and representative operational groups. In addition, a working display will need sample workpieces, sample raw materials, a power supply, skilled operators, and a suitable area from which visitors may safely observe the machines working. There is a need to retain or at least record the operating skills, techniques and knowledge of the men who ran the plant.

If Midland Workshops is used all or in part as a museum, it should not be just a Railway Museum featuring old rolling stock, but should be primarily a Museum of Engineering and Workshop practice, albeit as applied to the Railways. A joint exhibition of rolling stock with the Australian Railway Historical Society (see below) would be an additional attraction, and would give extra meaning to the display of workshops equipment.

However, there are already plenty of museums of rolling stock. What needs to be emphasised is that the Midland Workshops collection of equipment gives one of the most complete overviews of early to mid-20th century industrial engineering processes which could be found anywhere in the country. Midland Workshops has the potential to become an industrial museum of national or even international repute, at which the public could watch manufacturing processes happening which they can only read about anywhere else.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.5 OPTIONS FOR MUSEUM USE (Continued)

Great industrial museums in Germany and Switzerland, the Science Museum in London, and the Smithsonian in Washington DC, all depend on static collections of disused machinery for their major displays. At the Powerhouse Museum in Sydney, the opportunity for even a non-working display of historic powerhouse equipment was lost at the adaptation stage, and this well known "Museum of Technology" has only a meagre display of a few pieces of industrial machinery, unrelated to each other, or to the buildings they are in. The most important machine in the Powerhouse, the Boulton and Watt engine, has no relevance to the State of NSW, and although it can be rotated it serves no working function.

Another famous industrial museum site, related to the textile industry, is the town of Lowell in Massachusetts. Here is a whole town full of magnificent 19th Century mill buildings and water-power infrastructure, with not a single piece of textile machinery surviving for the National Parks Service to use in illustrating the work of the mills. In Macclesfield, UK, the silk industry has retained at least one silk mill complete in its pre-WW2 configuration, and it has become a very successful small working museum, producing silk cloth for the market. This attracts considerable public interest as single-trade museum. At Midland there are opportunities for demonstrating the manufacturing processes, and selling the products, of many different trades, giving enormous scope and variety of displays to inform and interest the visitors.

At Ironbridge, the most famous industrial museum in the world, there is no original working industry on display. There is a tiny village foundry, with a viewing gallery, producing bootscrapers & doorknockers which have a ready market, but the adjacent industrial-scale foundries on display are in ruins. There is a small woodwork shop, a bootmaker, a chemist shop, a pastry shop etc. but all on a very small village scale, and all "fake" in that they have been recreated or relocated from other areas to Ironbridge. The Museum management is hoping some day to set up a demonstration wrought-iron rolling mill, and demonstrate the manufacture of ceramic tiles in a former tile factory, but otherwise the working museum aspects of Ironbridge are extremely limited.

Nevertheless, Ironbridge Museum has more variety and public appeal than any other industrial museum, and visitors come from all over UK, and from the around the world, to see it. It has transformed a formerly depressed, almost derelict, industrial area into a very prosperous community, where local hotels, restaurants, souvenir shops etc., do a brisk trade, and where the authors overheard one resident complaining that all the tourists left no room for him to park his Jaguar.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.5 OPTIONS FOR MUSEUM USE (Continued)

In contrast to the village scale and static displays of Ironbridge, Midland could give working demonstrations of metal moulding and casting, metal machining, manual and mechanical blacksmithing, mechanical woodworking, patternmaking, hydraulic press forming, materials testing, and so on, using industrial-scale machines in their genuine industrial setting. This could be combined with ongoing commercial use of the machinery to meet the needs of government departments, or to provide a contract engineering service to commercial customers, eg. mining and logging companies.

The spaciousness of many areas of the Workshops, or the proximity of wide doorways, would allow for convenient viewing of work in progress, from defined walkways or viewing platforms on a programmed tour of the site.

For example, the Foundry at Midland could be adapted, by the addition of simple viewing galleries, to become an unique demonstration of a general foundry in action, producing iron, steel, aluminium and other types of castings for a variety of commercial customers, and with a number of bread-and-butter lines for sale to the tourists as souvenirs of the process they have been watching. The Foundry exhibition could be combined with ongoing commercial use of the Foundry, eg producing short-run jobs or experimental batches of castings for industry or government departments.

Under the Working Museum option it would also be appropriate for the Australian Railway Historical Society to occupy parts of Midland Workshops (possibly sections of Blocks 1 or 2) to house their historic rolling stock, and to be able to use the retained workshop equipment to assist with the maintenance of their collection (in conjunction with Working Museum and/or educational display, or commercial operation of the equipment). This would have the advantage of meeting A.R.H.S. needs, providing an appropriate future use and care of the heritage buildings and heritage equipment, and providing an additional opportunity for the equipment to be displayed in working context. A working display of the railway workshops equipment in conjunction with and complementing an A.R.H.S. display of railway rolling stock, signalling, and infrastructure, would add to the public interest in the Museum as a whole.

There should be sufficient spare space on the site to include a static museum display dedicated to the history of the Workshops and to the people who worked there. As a compact and individual set of structures, of an adequate size, and already containing an outstandingly appealing collection of machines, the Substation / Powerhouse / Boilerhouse complex should be considered for this project. This could become a home for a comprehensive interpretation of the working life of Midland, backed up by a static display of suitable artefacts from the collection.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.6 OPTIONS FOR EDUCATIONAL USE

The Working Museum would of course be visited by large numbers of school children with their families, or on organised school visits. However, a large and versatile Workshop like Midland would also be useful for training of engineering, technological and trade students.

The broad range of old workshop equipment available at Midland would be ideal for instruction of student engineers, trade apprentices etc., in basic workshop and machining practice (which is more easily demonstrated on these simple old machines than on complex modern ones). If some modern machines (eg computer controlled lathes) are retained, then the students can also be shown modern techniques. This should help them gain an understanding of how much engineering technology has evolved over the last century, and is likely to go on evolving into the next century.

The large industrial buildings with open spaces, overhead cranes, heavy-duty floors etc., would be suitable for university engineering, building or architecture schools to use as large-scale experimental or demonstration laboratories, as is already done at the University of NSW laboratory facility for testing full-scale building components, located in the former Randwick Tramway Workshops, Sydney. This could also incorporate commercially oriented experimental or pilot plant trials of mechanical, chemical or electrical plant by university researchers (perhaps in collaboration with commercial sponsors) along the lines of the Technology Park currently proposed for the former Eveleigh Railway Workshops, Sydney.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.7 OPTIONS FOR MIXED USE -

Static & Working Museum / Workshop / Educational / Industrial / Commercial

A mixed use combining several or all of the discussed options, to be carried on in separate parts of the Workshops, should certainly be considered, as that has perhaps the best chance of success. Neither a continuing railway workshops, nor Working Museums, nor commercial workshops, nor educational facility are mutually exclusive options. The Working Museum concept would not preclude commercial use of the Workshops by various leaseholders. The two could combine very well.

Indeed it would be preferable for the equipment and buildings to have ongoing commercial use to help pay for and justify their conservation, to maintain a valuable centre of engineering capacity and engineering jobs, and to allow visitors to see the equipment in a genuine working environment rather than the usual static, sanitised museum context.

Given normal maintenance, any wear and tear on the machines should be no worse than in the last 50 to 100 years of working life, and would be preferable to letting the machines rust through disuse. If the Working Museum was to undertake commercial work, then it would be preferable to retain modern machines as well as the heritage items, to increase the viability of the Museum as a contract workshop.

Lease agreements would have to be flexible enough to allow the mix of uses and leaseholders to be adjusted in future, to boost successful uses and replace failures in light of real results.

A Working Museum could only be enhanced by the development of displays which were viable industries in themselves. The potential commercial/industrial possibilities are many and varied.

Businesses forming part of the Museum structure would have the potential to continue doing railway work. At a basic level this would be for Westrail, to supplement outside contract railway workshops, or to provide a back-up facility should the outside contractor(s) fail. Looking more widely, and considering the closure of so many other railway workshops, there is a potential market Australia-wide and overseas for rolling stock parts, for repairs and for per-way components. The potential customers are mining companies, the National Railway, all the State railway networks and even the countries in S.E. Asia which are trying to get their railways together again (eg. Vietnam and Thailand).

There are also opportunities for commercial railway heritage work, particularly in (say) the Machine Shop and Wheel Shop. Midland has the expertise and could produce parts and repair steam locomotives for the other states and for other countries such as those mentioned above which are still operating on steam technology but do not have the workshop infrastructure that still exists at Midland.

3. OVERALL RECOMMENDATIONS AND CONSERVATION POLICY

3.7 OPTIONS FOR MIXED USE - (Continued)

The Working Museum, or leaseholders forming part of the Museum, could also undertake general contract engineering jobbing work, eg.: making patterns; making moulds and castings; running specialty wood mouldings for boats or for restoration of carriages, houses etc.; repairing large diesel crankshafts; pressing sheet steel, copper or aluminium into dished shapes; pressing large axles on or off generator rotors etc.; machining large components on their unusually large planing, milling, and boring machines; and so on. Museum leaseholders could also provide a physical testing, chemical analysis and metrology service for industry or other government departments.

Such a collection of ventures would need a strong overall management organisation, led by a manager with imagination and the ability to think laterally, and with more business understanding than the typical Museum Director. The management need not be part of a Government Department, but could be an umbrella organisation such as would run large markets or a technology park or manage places like Darling Harbour or The Rocks in Sydney.

The management organisation would be responsible for maintaining commercial viability of the overall complex, for physical maintenance of the fabric of the buildings, for selecting suitable leaseholders and for monitoring their activities to ensure that they do not adversely impact on the heritage values of the machinery and buildings, or on the amenity of the other leaseholders and the local community.

CODE	EQUIPMENT OR TRADE GROUP	REMARKS
AD	**Administrative**	Management, office work, timekeeping, design
AM	**Staff Amenities & Welfare**	Comfort, health
BB	**Blacksmith - Bolts, Nuts & Dog Spikes**	includes rivets & headed pins
BD	**Blacksmith - Drop Hammers**	+ associated furnaces, presses
BH	**Blacksmith - Steam or Air Hammers**	+ associated furnaces & cranes
BL	**Blacksmithing - Traditional**	handtools, forges, anvils
BM	**Blacksmithing - Miscellaneous**	
BO	**Boilermaking - General**	cutting & shaping plate, angle-iron etc
BR	**Boilermaking - Riveting**	specialised riveting equipment
BU	**Buildings & Building Details**	(here) building components as industrial artefacts
EL	**Electrical, Electronic**	Electrical trades, and some electrical devices or components
FF	**Foundry - Ferrous Casting**	
FM	**Foundry - Moulds & Mouldmaking**	Moulds for ferrous or non-ferrous castings.
FN	**Foundry - Non-Ferrous Casting**	
FU	**Furniture**	Includes cupboards, plaques, noticeboards.
HY	**Hydraulic Power**	Supply of high pressure water or oil.
IN	**Instrument Making & Repair**	Maintenance of clocks, watches, gauges
LS	**Lineshaft System**	Remnants of overhead pulley system to drive machinery.

CODE	EQUIPMENT OR TRADE GROUP	REMARKS
MH	**Mechanical Handling**	Cranes, trolleys, weighing scales etc, serving general areas
MI	**Miscellaneous**	
MS	**Machine Shop - General**	includes general-purpose machine tools found in other Shops
MT	**Machine Shop - Toolmaking**	Special-purpose toolmaking machine tools.
MW	**Machine Shop - Wheel Shop Section**	
PM	**Plant Maintenance**	Fitter's toolboxes etc.
PT	**Painting**	
QC	**Quality Control**	Inspection, measurement, testing, laboratory analysis.
RS	**Rolling Stock - Assembly & Repair**	Special equipment for servicing locos, carriages, wagons.
SI	**Site Feature (other than buildings)**	
SM	**Sheet Metal**	Tinsmith, Coppersmith
TA	**Tarpaulin Shop**	
TR	**Trackwork & Perway**	Rails, points, sleepers, etc
UP	**Upholstery**	aka Trimming
UT	**Utilities**	Supply of electric power, air, low-pressure water, drainage.
WO	**Wood Mill**	Manual and mechanised woodworking, including Saw Doctor
WP	**Patterns and Patternmaking**	Mostly wood-working, but includes some metal pattern-making.
ZZ	**Items not identified**	

SITE No.	NAME OF BUILDING OR FEATURE	REMARKS
0	**Various - beyond Workshops**	Cottages, pubs etc nearby
1	**C.M.E.'s Office**	Chief Mechanical Engineer's Office
2	**Laboratory**	
3	**Railway Institute**	
4	**Gatekeeper's Office**	aka Security or Receiving Shop
5	**Time Keeper's Office**	
6	**Westinghouse Brake Shop**	
7	**Annealing Furnace**	
8	**Apprenticeship Buildings**	Cluster of modern portable sheds
9	**Works Management Centre**	Originally a Tool(making) Shop
10	**Canteen**	
11	**Recreation Hall**	
12	**Toilets**	
13	**Store near Foundry**	
14	**Foundry**	
15	**Old Sand Shed**	now partly pattern storage
16	**Pattern Store**	cgi sheds joined with brick Water Tower 83
17	**Pattern Shop**	
18	**Toilets**	
19	**Blacksmith's Tools (Shed)**	
20	**Store**	
21	**Store**	
22	**Power House**	Boiler House 23 is considered separately
23	**Boiler House**	Now the Copper Shop. Adjoins Power House.

SITE No.	NAME OF BUILDING OR FEATURE	REMARKS
24	**Panel Shop**	
25	**Radiator Shop**	old house?
26	**Element Shop**	= Old Copper Shop + shed with bender
27	**Fuel Shed**	Drains or refills diesel fuel in locos
28	**(Loco) Weighbridge**	checked axle loads on steam locos
29	**Electrical Store**	
30	**Electrical Shop**	includes instrument/watch shop
31	**New Plating Shop**	
32	**Old Plating Shop**	now Electrical Store
33	**Old Tarpaulin Shop**	now Electrical Shop
34	**Elevated Circular Tank**	Fuel Tank
35	**Store**	one of a row of cgi sheds south of Main Store
36	**Store**	one of a row of cgi sheds south of Main Store
37	**Store**	one of a row of cgi sheds south of Main Store
38	**Store**	one of a row of cgi sheds south of Main Store
39	**Store**	one of a row of cgi sheds south of Main Store
40	**Store**	one of a row of cgi sheds south of Main Store
41	**Store**	one of a row of cgi sheds south of Main Store
42	**Annexe to Main Store**	cgi extension to brick Main Store
43	**Main Store**	General Store (west) plus Oil Store (east)
44	**Store**	
45	**Block 3**	Machine + Tool + Wheel + Fitting Shops
46	**Block 2**	Boiler Shop + Blacksmiths / Spring Shop
47	**Block 1**	Car & Wagon Shop + Wood Mill

SITE No.	NAME OF BUILDING OR FEATURE	REMARKS
48	**Store**	
49	**Store**	
50	**Store**	
51	**Store**	
52	**Flanging Shop**	See also Pumphouse Annexe 84
53	**Steel Store**	
54	**Test Room**	originally paint mixing?
55	**Store**	
56	**Store**	
57	**Heavy Vehicle Maintenance**	aka Heavy Traffic?
58	**Fibreglass Shop**	
59	**Track Equipment**	
60	**Store**	
61	**Store**	
62	**Timber Store**	
63	**Loco Spray Paint Shed**	
64	**Paint Shop**	includes Trimming Shop in south bay
65	**Grit Blasting**	
66	**New Tarpaulin Shop**	
67	**Old Wash Shed**	
68	**Old Sand Blasting Shed**	
69	**Water Treatment Plant**	Neutralises effluent from Plating etc.
70	**Loco Test Building**	aka Dynamometer
71	**Asbestos Building**	Removal of asbestos from rolling stock

SITE No.	NAME OF BUILDING OR FEATURE	REMARKS
72	**Bike Shed**	includes staff garage
73	**War Memorial & Garden**	Statue etc., east of C.M.E.'s Office
74	**Salvage Yard**	
81	**Health Centre**	First Aid
82	**Substation**	Annexe to Power House 22
83	**Water Tower (brick)**	Adjoins cgi Pattern Store 16
84	**Pumphouse (Flanging Shop)**	cgi annexe at east end of Flanging Shop
85	**Cooling Water Tanks**	
86	**Service Tunnel (Conduit)**	beneath roadway west of Blocks 1, 2, 3 etc.
87	**Nissen Sheds (Salvage)**	
88	**Yardman's Hut (Salvage)**	
89	**Wagon Spray Paint Shop**	
90	**Yard**	General outdoor areas in Workshops site
91	**Rail Roads (Tracks)**	
92	**Coal Dam & Structures**	
93	**Square Cast-iron Tank**	south of New Plating Shop
94	**Septic Sewerage System**	
95	**ARHS Storage Sidings**	Off Workshops site, east of former Midland Station
96	**Pedestrian Overbridge**	Over main rail line north of the Workshops
97	**Former Midland Station**	On main rail line north of the Workshops
98	**Flash Butt Welding Yard**	Off Workshops site, to ENE.
99	**General Views**	Groups of Workshop buildings or features

Group AD ADMINISTRATIVE

SUMMARY

This group covers administration of the Workshops, including management, general clerical work, timekeeping, and engineering design. The Chief Mechanical Engineer's (C.M.E.'s) Office was the grandest building on site, and housed staff of the C.M.E. and the Works Manager. The C.M.E. had overall control of the purchase and maintenance of rolling stock. The Works Manager was subsidiary to the C.M.E. and managed the staffing and operation of the Workshops. Administration of the Workshops was a major task, involving a lot of people. After World War Two, the C.M.E.'s Office was extended and some of the Works Management staff were relocated to Building 9, a former Toolmaking Shop.

Office methods and equipment have changed dramatically over the last 90 years, from ink bottles, steel-nib pens and early typewriters to ball-point pens, computers, and laser printers. No early office equipment was found at Midland, apart from one small paper punch (No.8148 in the Saw Doctor's compound) and a number of spring clips for holding job cards (an example, No.8162, was photographed in the New Tarpaulin Shop). Those items are old, but could not be definitely dated.

Other surviving physical reminders of administrative systems at the Workshops are the docket system (No.8004) and Bundy clocks (No.8009) used to check workers on and off the site, possibly since the 1920s. Working hours were supervised by many clocks in individual Shops, with a controlling Master Clock in the Works Manager's Centre (No.8134). One early clock survives in the Powerhouse (No.8080), close to the siren controls (No.8087) which marked the daily start & stop work times throughout the Workshops and were heard around the district.

Many documents have survived at Midland, most notably a large collection of drawings of buildings and plant held in the strong-room of the C.M.E.'s Office (see photos under item No.8234). Some of these drawings date back to alternative designs of the Workshops proposed in the late 1890s. There are more recent plant records and plant layout plans (No.8235) in the Plant Engineer's Office.

The Plant Cards (No.8236) have been the principal source of documentary information about much of the machinery in the Workshops. Unfortunately the copies of the cards used by us appear to be an incomplete collection. It is hoped that cards still exist to identify many of the inventory items which had to be given arbitrary numbers in the 8000 series. No cards were seen for the items of plant which have become obsolete, or which have been disposed of in the past. Such records would give a valuable insight into past operation of the Workshop, and these records need to be retrieved and archived along with the current plant cards.

Group AD **ADMINISTRATIVE**

SUMMARY (Continued)

Other documents are scattered in various Shops. One collection of rolled drawings photographed was in the Foundry - No.8233. Numerous files were held at Midland, mostly c1950s or later, but these were being culled and dumped or transferred elsewhere in 1993. These surviving documents have or could have considerable archival value. They should be assessed by an archivist, and taken into archival care by Westrail or by Battye Library. Ultimately, these documents could survive long after the physical Workshops disappear.

Many documents of historic value related to the Workshops are held off site, notably archival photographs held at Westrail Head Office and at Battye Library, and typescript annual reports from the C.M.E. to Head Office, giving more details of Workshops operations and equipment than do those found in the condensed version appearing in the W.A. Railways Annual Reports. The copy of the C.M.E.'s Annual Reports held at Midland were said to have been recently destroyed. There is a typed copy of each C.M.E.'s Annual Report tucked at the back of one particular set of printed Railways Annual Reports, held at Westrail Library, and this is probably the only copy to have survived.

Group AD **ADMINISTRATIVE**

SIGNIFICANCE

The surviving physical reminders of the Workshops Administration, and the documents generated by the Administration are significant for reasons including the following:

* the artefacts (Clocks, Sirens, Bundy Clock, Docket Boards) clearly evoke the history of the Workshops, and are particularly reminiscent of the people who worked there and their working conditions;

* the timekeeping, attendance control system, including the Bundy Clock, Docket Boards and Dockets, and the compressed air (formerly steam) operated Sirens, all belong to a technology which has been superseded elsewhere and replaced by electronic instrumentation and computers. The Midland system has worked efficiently for at least 60 years, and probably much longer, and is still in working order. Except in places like mines, where systems similar to dockets are still used to keep track of who is underground, such timekeeping systems are now extremely rare;

* the sole surviving relics of early 20th Century office equipment (a small paper punch and a few work-order boards) would be insignificant if any more substantial office equipment had survived. In the event they are significant because of their rarity, and because of their ability to demonstrate past record-keeping methods;

* the documents (Drawings, Plant Cards etc.) have very high significance as the most detailed and complete record available of the buildings, the site services, individual items of plant, the location of plant, and the evolving operational layout of the Workshops. This information is of historical interest, and will also be of great value in planning future conservation and re-use of the buildings and site.

Group AD **ADMINISTRATIVE**

RECOMMENDATIONS & CONSERVATION POLICY

* The documents (Drawings, Plant Cards etc.) still at Midland should be taken into archival care, as the primary source of future information and research about the history and operation of the Workshops. If necessary, the documents could be removed from the Workshops to the Westrail archives and/ or Battye Library for safekeeping, with selected items copied for display in a future museum of the Workshops organisation and people.

* The Inventory notes some documents seen at the Workshops during the inspection of plant. The Workshops should be searched for other documents, such as staffing records, performance reports, archival photographs (said to have been in the Plant Engineering Office, but not found). No documents should be disposed of until assessed by an archivist with adequate knowledge and/or advice about the Workshops' operations and technology.

* Former employees should be invited to supply additional photographs for copying, and to assist oral historians in compling a more detailed record of the Workshops.

* Personnel and administrative artefacts should be conserved on site, but if necessary moved to a more secure part of the site, for eventual display in a museum of Workshops activities and people. All personnel dockets should be collected, including the many round brass ones which must have been in use in the past before being replaced on the boards by square dockets. Samples of pay sheets, time records, job cards, etc., should also be conserved if found.

* Although not strictly part of the Workshops' site inventory, the typescript copies of the C.M.E.'s Annual Reports held at Westrail Library, should be duplicated and copies lodged at the Workshops museum and at Battye Library.

Group AD **ADMINISTRATIVE**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8001	PERSONNEL DOCKETS & BOARDS (MAIN)	5	A	A	D	O
8004	PERSONNEL DOCKETS & BOARDS (SHOP)	45	A	A	D	R
8009	TIMEKEEPER'S CLOCK (aka "BUNDY")	5	A	A	D	R
8072	WORKS MANAGER'S BOX No.3	22	A		D	O
8080	J.W.Benson WALL CLOCK	22	A		W	P
8085	WALL CLOCK	82	B		O	R
8087	WORKSHOP SIRENS	22	A	A	W	Y
8087	WORKSHOP SIREN HANDLES	22	A	A	W	Y
8134	Julius Sax & Co. MASTER CLOCK	9	B	A	W	O
8148	OLD OFFICE PAPER PUNCH	47	A		D	R
8233	FOUNDRY DRAWINGS	14	?	?	H	R
8234	ARCHIVAL DRAWINGS AND OTHER RECORDS	1	A	A	A	R
8234	ARCHIVAL DRAWINGS	1	A	A	A	R
8235	PLANT ENGINEER'S DRAWINGS	9	A	A	A	R
8236	PLANT CARDS	9	A	A	A	R
8237	ARCHIVAL PHOTOGRAPHS	9	A	A	A	R

Group AM STAFF AMENITIES & WELFARE (Comfort & Health)

SUMMARY

Apart from the initial provision of toilets (latrines & outdoor urinals built on the outside face of the Shop walls, all served by a septic system), little seems to have been done to improve the on-job comfort of most employees until during or soon after World War Two. Then the influx of female munitions workers and the influence of the Commonwealth Government led to more thorough enclosure of the urinals and to upgrading of washing, changing and eating facilities. Heating was designed into the administrative offices in 1902-04, but the large workshops buildings had to wait until 1951-52, before 106 Tangye solid fuel stoves (Plant Nos. 1700 to 1807) were installed as space heaters, burning wood scraps. Refrigerated drinking water coolers were introduced at the same time.

Small First Aid boxes (Plant No.8159) were provided in the various Shops, and a First Aid Room with a trained nurse was provided in 1920. The present First Aid Room, said to have originally been a Gatekeeper's Office, and later moved to its present position, still contains a dentist's chair (No.8031) used to make the examination of eye injuries more comfortable for the patient. This chair may have been acquired as early as the original First Aid Room. The original facilities did not extend to an ambulance, and the employees had to contribute their own funds to provide an on-site ambulance. The primitive state of occupational health education, precautions and preventative treatment, at least until the 1950s, is attested to by the content of a notice "Advice to persons working with lead ....." (No.8053), which implies that drinking milk will protect employees against lead poisoning.

Recreation and training were rather better catered for. A lavish two-storey brick Railway Institute and Technical School was erected in 1914, with classrooms, library and billiard room. A simpler c.g.i. gymnasium was erected alongside, but has since been demolished.

Group AM STAFF AMENITIES & WELFARE (Comfort & Health)

SIGNIFICANCE

The small number of artefacts listed in the Group AM, Staff Amenities & Welfare, are significant for reasons including the following:

* Other than toilets and canteen buildings, these Group AM artefacts (and some in Group AD) constitute the main visible evidence representing the thousands of people who worked in the Workshops over the past 90 years.

* These Group AM artefacts represent two of the main concerns of the employees, ie., comfort (or discomfort) of working conditions, and exposure to injury or dangerous chemicals.

* The dentist's chair represents one of the most common injuries at Midland, caused by foreign objects in the eye.

Group AM STAFF AMENITIES & WELFARE (Comfort & Health)

RECOMMENDATIONS & CONSERVATION POLICY

* Samples of the Tangye Stoves should be kept in locations which will be used for a working museum or museum displays. They could continue in use for winter heating of work areas. Spares should be kept for repairs or additions to display areas.

* The Dentist's Chair should be conserved for display in an exhibition of the Workshops and its People, along with representative small aids, such as eyewash bowls and eye pads. Although not historic, a representative sample of other first aid equipment and posters should be kept to supplement this display.

* The Lead Poisoning notice should be kept for display in an exhibition of the Workshops and its People.

* First aid and injury records should be kept for archives, if these can be collected.

Group AM **STAFF AMENITIES & WELFARE**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1704	Tangye SPACE HEATING STOVE	47	B	B	S	O
8031	DENTIST'S CHAIR	81	A	A	D	O
8053	SAFETY NOTICE - LEAD POISONING	26	A	A	D	O

Groups BB BD BG BH & BL BLACKSMITHING

The Blacksmithing Group has been divided into five sub-groups, identified as:

Group BB - BOLTS, NUTS & DOG SPIKES

Group BD - DROP HAMMERS (with FURNACES & PRESSES)

Group BG - SPRING MAKING & REPAIR

Group BH - STEAM or AIR HAMMERS (with FURNACES & CRANES)

Group BL - TRADITIONAL BLACKSMITHING

Group BB BLACKSMITHING - Bolts, Nuts & Dog Spikes

SUMMARY

At the time the Midland Workshops was established, all railways used large quantities of rivets, nuts, bolts, and dog spikes (large headed steel spikes for securing rails to wooden sleepers), and it was common practice for Australian railway workshops to make such components for themselves. WAGR had already purchased a Greenwood & Battley "Horsfal" nut & bolt forging machine (Plant No.224) in 1896, for use in the planned Midland Workshops, and also intended purchasing another nut & bolt machine when the Workshops were built. The Horsfal Nut & Bolt Machine was one of the first installed at Midland, being temporarily housed in the Timber Shed in 1903, before the brick Shops were built.

Nut & bolt machines could forge heads on round bars to make un-threaded bolts or rivets, or could stamp blank square or hexagonal nuts from flat bar. The threads were formed on the nuts or bolts in a subsequent process, in other machines.

The 1920 Annual Report of the W.A.G.R. noted that "A policy has been established of manufacturing within our shops numbers of articles which have hitherto been purchased from outside the State. It is considered that this will not only be economical but will have the advantage of keeping expenditure within Western Australia, and, with this policy in view, it has been decided to obtain a plant for manufacturing bolts, fishbolts and dog spikes at a cost of 11,000 pounds."

In 1922 WAGR installed a complete set of machinery for the dog spike line, including an Ajax continuous heading machine (No.594) which could automatically crop and head round bar stock to make bolts or rivets, at a much faster rate than the Horsfal. When fitted with different dies, the Ajax machine could also make headed dog spikes from square bar. Although Midland's production of rivets and standard bolts ceased long ago, the Ajax has continued to make dog spikes and special bolts for fish-plates (to join rails end-to-end) for at least 70 years, up until the 1993/94 closure of the Midland Workshops.

Group BB **BLACKSMITHING - Bolts, Nuts & Dog Spikes**

SUMMARY (Continued)

Midland has had other heading or bolt forging machines, notably a 1950s Covmac machine (No.1848) for heading bolts or "pins" up to 2 inch (50mm) diameter, which was still used occasionally up to 1993. A larger Covmac (No.1850), which could head "pins" up to 3.5 inch diameter, never worked well and was eventually scrapped. It still survives in several pieces in the Salvage Yard. Another new dog spike machine was tried in the 1950s, but it was a failure and was returned to its manufacturer, while the old Ajax faithfully worked on.

The existing dog spike, bolt and nut-making line in the Blacksmiths' Shop includes the Ajax, Horsfal and Covmac heading machines, several furnaces (Nos.597 & 1920 are listed) for heating and softening the bar stock before heading, two finning presses (Nos.601 & 604) for trimming excess "flash" from the edge of the forged head, a dog spike "pointing" machine (No.600), a threading machine for bolts (No.603), and another threading machine for nuts (No.599).

The machines are linked by a set of rails in the floor, with metal flat-bed trolleys (No.8014), to carry the red-hot headed bolts or spikes from the heading machine to the later machines. After the pointing machine operation, the dog spikes were bagged and weighed on an Avery Platform Scale (listed as part of the line).

Right up to the closure of the Workshops, the Midland dog spike line was consistently running overtime to keep up with demand. As at 1993 this was the only operating dog spike line in W.A., and to our knowledge the last operating line in Australia. NSW, Queensland and Victorian Railways had already shut down their own dog spike lines, assuming that local private industry would have capacity to meet the demand. We have been told on good authority that the NSW Railways now buys dog spikes from a local supplier, but that they are made in China, and instead of being cheaper they are much more expensive than the ones NSW Railways made themselves. Meanwhile, the NSW dog spike machines now sit idle, and the men who operated them have been laid off as redundant.

The Midland Dog Spike Line has very high heritage significance. It should also have future commercial viability supplying dog spikes and fish-plate bolts to Railways throughout Australia, and possibly to the many countries in S.E. Asia which are at present engaged in rehabilitating their own railway networks.

Group BD BLACKSMITHING - Drop Hammers (with Furnaces & Presses)

SUMMARY

The essential components of a drop hammer are a heavy iron "hammer" sliding in a set of tall vertical rails (rather like a guillotine), a motorised mechanism for lifting the hammer to the top of the rails and then letting it drop onto an anvil at the bottom of the rails, and a pair of matching dies mounted half in the hammer and half on the anvil. The mating faces of the dies are hollowed out to form a cavity in the shape of the object to be forged (eg. a coupling hook for linking wagons end-to-end).

A blank piece of heated steel of the correct volume is placed on the fixed bottom die (attached to the anvil), then the other die attached to the hammer is raised and dropped, striking the workpiece and forcing the metal to flow into the shape of the die cavity. The workpiece blank is always made slightly oversize, to ensure the cavity is completely filled, and leaving a little spare metal to escape as a thin "flash" in the gap between the two dies. Due to the consistent energy of the falling hammer, the over-filling of the die, and the good metallurgical properties of forged iron or steel, drop forged products tend to be very consistent in size and reliable in strength. The dies can be expensive, and so drop forgings are used only where production quantities are high enough to warrant the initial expense.

Midland has four drop hammers of various sizes and ages. Three are Massey drop hammers (Nos.1852, 2064 & 2196) rated 12.5, 20 & 15 cwt respectively (ie. about 600, 1000 and 750 kg hammer weights). All three Massey drop hammers date from the 1950s, and all are powered by electric motors. All three have associated pre-heating furnaces, and post-forge finning or trimming presses to remove the "flash". Drawings, plant records, and patches in the floor indicate that there were several more drop hammers near the Masseys, but these have been removed.

By far the largest and oldest drop hammer is a 40 cwt (2 ton) hammer made by Brett's Patent Lifter Co. (No.238), which was installed in 1911. It was steam-powered, with a one-turn vane type steam motor raising and dropping the hammer. The support frame of the Brett is designed to accommodate at least two and possibly three similar drop hammers side-by-side, but only one hammer is there now. The Brett remained in use up until 1992 or 1993.

Associated with the drop hammers are pre-heat furnaces and trimming presses, tongs for handling hot metal workpieces into and out of the furnaces and hammers, and a large number of drop forging dies and trimming/finning dies, to make a wide variety of railway components. Some dies are stored near the drop hammers, but most are in a shed west of the Blacksmiths Shop, or outdoors on pallets south of the Shop. The dies, including those in the Blacksmiths Tool Shed (No.8213) and those scattered in other locations in or near the Blacksmith Shop, should be conserved with the drop hammers, furnaces and presses, as well as some samples of components made in the dies.

Group BG BLACKSMITHING - Spring Making and Repair

SUMMARY

A major task of the Blacksmiths Shop was to make new coil or leaf springs (eg. for use in the axle suspension or end buffers of locos, wagons and carriages), and to re-temper and reset springs which had been overloaded and distorted. In the 1950s the Spring Shop was re-equipped with Henry Berry hydraulic machines for assembling and disassembling (stripping) leaf springs and their containing "buckles", and for testing and deliberately pre-straining or "scragging" springs to improve their life. The Spring Shop also got new Fairbank Brearley electric-powered machines for forming heavy coil springs, and for tapering the ends of coil springs so that they sit flat. The Workshop had spring forming and tempering facilities prior to the 1950s, but no record of the style or maker of these machines has been provided.

In 1993, the Spring Shop still has the machines acquired in the 1950s. In addition, it has various dies and mandrels for the spring coiling and buckling machines, and a large number of small mandrels for hand-coiling light springs. Although dated 1951, and now operated by hydraulic oil, the Henry Berry Spring Buckling Press and Stripping Press look like much older machines designed for water-hydraulic operation. (Similar presses were in place and operated by water in 1903/04, according to several old drawings. Presumably they were replaced by these 1950s machines.) These machines constitute a comprehensive Spring Shop of high heritage significance, very suitable for a working museum display and for possible ongoing railway use or for commercial use for short-run or repair work (eg. for truck springs).

Group BH BLACKSMITHING - Steam or Air Hammers (with Furnaces & Cranes)

SUMMARY

The two-legged arch steam hammer was invented by Nasmyth in 1839. It was a major advance in engineering, giving the capacity to forge much larger pieces of iron than was possible by hand, and enabling large strong wrought iron machine shafts etc. to be made. Midland Blacksmith Shop has a Tannet & Walker Arch Steam Hammer (No.226), based on Nasmyth's design, which was installed in 1902 (? vide Plant Card), probably in its present location at the south-east corner of Block 2. This area was originally built in 1902-04 as a "Forge", separate from but intended to be joined to the 1902-04 western part of Block 2, and actually joined in c1911. The Tannet & Walker arch hammer remained in use until recently. It is not the oldest such hammer in Australia, but is possibly the last to have been in regular use. (According to Plan 1028, dated 1903, a smaller 7 cwt Nasmyth Wilson steam hammer was installed first in the Timber Shed before the main Shops were completed, but that hammer no longer exists.)

The arch hammer has a flat-faced anvil and flat-faced 50 cwt (2.5 tonne) hammer, which can be used either to strike the workpiece directly, or to strike various-shaped swaging dies held above or around the workpiece. A typical job for a steam hammer would be to form a large axle shaft or die block to approximate shape, to be later machined to exact size in the Machine Shop. Hammer forming requires a high level of skill and co-operation in the team of two or three men who manipulate the workpiece and dies, and control the hammer blow. Close to the arch hammer are two riveted-construction furnaces for pre-heating the workpieces and/or pre-heating the dies and anvil. These furnaces (Nos.65 & 70) are supposed to have been made in the 1920s, but look older.

Midland also has several Massey or Davy single-leg "clear area" steam hammers (Nos.228, 247 & 248) acquired c1911-1913. These did not deliver such a heavy blow as the arch hammer, but worked faster and were better suited to smaller jobs. Many of these jobs involved use of pairs of dies mounted on long spring handles, which normally held the dies slightly open but directly facing each other in correct alignment. The dies were usually cut in simple shapes, such as two opposing half-round cavities to form a long cylindrical shaft by a series of overlapping blows on the workpiece. The dies were not usually fastened to the hammer or anvil directly, but were placed on the anvil under the hammer by the operators, and manually manipulated to achieve the required shape of workpiece.

These steam hammers and dies shaped metal workpieces in a way similar to traditional manual blacksmithing methods, but on a larger scale. With reliance on the operators' judgement, steam hammers produced less precise products than drop hammers, but were very versatile and used cheaper dies - and so tended to be used for one-off or short-run jobs, or jobs too large for the drop hammers.

The steam hammer workpieces tended to be large and heavy, and often radiated extreme heat, especially those forged with the arch hammer. It was common for the heavy workpieces and heavy dies to be handled by one or two of the several large jib cranes (Plant Nos. 242, 243, 652, 653 & 3403) alongside the hammers. The operators had sheet metal shields they could get behind if necessary.

Group BH BLACKSMITHING - Steam or Air Hammers (with Furnaces & Cranes)

SUMMARY (Continued)

A set of c1904 drawings of The Forge, at the SE corner of the present Block 2 (then isolated from the original western half of Block 2), shows what appears to be the Tannet Walker arch hammer, two furnaces, a gas producer (for the furnaces ?), and an external boiler, presumably to supply a local source of steam to the arch hammer (instead of piping steam all the way from the Powerhouse). The single-sided clear-space steam hammers introduced later (c1911-1913) appear to have been installed to run on steam piped from the Powerhouse boilers. Possibly the original "Forge" boiler could not produce enough steam for all the hammers.

After the Powerhouse generators shut down in 1917/18, the Powerhouse boilers were kept going for several years to supply the hammers. Later, some of the boilers were relocated to outside the east end of the Blacksmiths Shop, to provide steam to the hammers. There are large round holes in the east wall, presumably for steam pipes to go through from the boilers to the hammers. Later still, the boilers were removed, and the hammers were modified slightly to run on compressed air from the Powerhouse compressors.

A 1952 Commonwealth Government Report on The Structure and Capacity of Australian Manufacturing Industries (page 166), listed the country's major forging shops, and put the West Australian Government Railways Workshop at Perth (ie. Midland) at the top of the list, as "one of the largest smith-forging shops in Australia.... which has numbers of power hammers, ranging in capacity from 5 cwt up to about 2 1/2 tons." A few other workshops had individual larger hammers, but Midland appears to have had the most impressive group seen. It is not clear whether that assessment included the six electro-pneumatic hammers installed in 1952 (see below).

In 1952 six self-contained Massey electro-pneumatic hammers were installed at Midland. These had an air-piston hammer supplied with air from an integral motor and compressor built into the hammer's rather bulky frame. They delivered lighter but faster blows than the steam hammers. They had the advantage of being able to be started at short notice at any time of day or night, without the boiler steam supply or Powerhouse air compressors having to be running as well. These hammers were therefore preferred for light short-run jobs, intermittent night-shift work, weekend work, etc. They represent the later evolution of the steam hammer to meet changing industrial conditions and needs. As at 1993, one of the electro-pneumatic hammers is still in situ and operable (No.1845), but the others have been removed. One is still lying in the Salvage Yard, partly dismantled (No.1844).

Large numbers of spring-handle die sets, tongs and other aids (No.8026) for use with the steam/air hammers are still inside the Blacksmiths Shop, while more are in the Blacksmiths Tool Shed west of Block 2, outside the south wall of Block 2, and in a yard adjacent to the Salvage Yard. These should all be collected together and conserved for display in a working museum context, and for possible future commercial use of the steam/air hammers.

Group BL **BLACKSMITHING - Traditional**

SUMMARY

Bays 3 & 4 of Block 2 were originally planned as a "Smithy" to hold 54 (later 68) blacksmith's hearths or forges, also called "fires". There blacksmiths would heat pieces of steel in coke fires, and shape the hot steel on anvils by traditional manual techniques using hand-held hammers, swages, "flatters", etc. The smithy made or repaired the smaller steel components of carriages, wagons & locos, such as brackets, handles etc.. The smithy also made or repaired tools for use by other Shops (eg. hardened & tempered cutting tool blanks to be finished in the Tool Shop, for use in lathes and other machine tools), and picks etc., for use by per-way gangs.

To get the coke fires sufficiently hot they were fed with a ducted air supply from a central fan. It is not clear what fan was used in the interim stage 1904-1911 when only half of Block 2 was built, but it must have had marginal capacity. After Block 2 was extended in 1911/12 and the full complement of hearths was in place, the fires were supplied with air from a large "Alldays and Onions" centrifugal fan (No. 508), which was installed in 1913 and is still in place today.

The fumes from the original 54 (56?) hearths were drawn away by a network of under-floor firebrick flues connected to several steel chimneys, (see E.E.L. Plan 11723/40, Sheet 20). An undated drawing (Plan 11723/40, Sheet 43) shows twelve additional hearths or "Fires" (numbered 57 to 68), connected to an overhead iron flue. The floor was originally covered in earth and ashes, which the 1902 Select Committee saw primarily as a cost-cutting measure, but which has always been the traditional flooring for a Blacksmiths Shop, because it is comfortable underfoot, and stops sparks and hot metal fragments from bouncing around - possibly into shoes or trouser legs.

By 1993 all but one of the 68 blacksmith's hearths or fires had been removed from the Blacksmiths' Shop, and only one survived (listed as a forge and hear given an arbitrary No. 8109). The original tall steel chimneys had also been removed, but a chimney recess still exists in the external brick wall (see No.8251), and it is likely that the associated network of underfloor brick flues still exists.

Most of the traditional blacksmiths hand tools have been scrapped, reportedly as part of the modernisation programme recently undertaken to achieve Quality Assurance certification. A small number of traditional blacksmith's hand tools remained in the Blacksmiths Shop in 1993, while a few others were found in the Panel Shop, the Track Equipment Shop, the Heavy Vehicle Maintenance Shop, the Flanging Shop, etc. (See Nos. 8013, 8027, 8035, 8060, 8061, 8105, 8109, 8110, 8113, 8241.)

Although the surviving set of traditional hand tools in the Blacksmiths Shop is sparse, the other sets if gathered together would form a comprehensive collection of very high heritage significance, and of great value for interpretative display in a working museum.

Group BM **BLACKSMITHING - Miscellaneous**

SUMMARY

The Blacksmith Shop has furnaces and oil quenching baths used for heat-treating springs, tool steel etc., to get the required properties of hardness, strength and toughness in the finished product after forming. the same area, in the NW corner of the Shop, contained annealing furnaces for gently heating formed or welded steel objects to allow undesirable locked-in stresses to dissipate. The annealing furnace is old (No.660, installed 1925). The several quenching baths look relatively new, and of low heritage significance, but would continue to be necessary if tool and spring heat treatment are to be carried out in future. Several other furnaces (Nos.3751 & 3759) are undated, but appear fairly old. They add to the usefulness and completeness of the Blacksmiths Shop.

The large annealing furnace (No.660) has a travelling table on wheels, which is loaded with items to be annealed, then hauled into the furnace by means of a small hand-operated winch (No.3285). This winch, despite its high plant number, is at least 90 years old, and was probably one of the very early plant items at Midland.

Other items included in the miscellaneous classification are several products of the Blacksmith Shop, including hanging signs (No.8025) and a pair of gates (No.8108). It would enhance the interpretative value of the Blacksmith's Shop if a variety of more typical products could be collected for display.

Groups BB BD BG BH & BL BLACKSMITHING

SIGNIFICANCE

Items of the Blacksmithing class, including equipment associated with the Dog Spike Line (Group BB), the Drop Hammers (Group BD), Spring Making (Group BG), Steam & Pneumatic Hammers (Group BH), Traditional Blacksmithing (Group BL), and some miscellaneous items connected with Blacksmithing (Group BM) are significant for reasons including the following:

* The manual blacksmithing hand tools, anvils, worktables etc., and the solitary surviving forge, hearth or "fire", represent the traditional blacksmith trade which was once an important part of the Workshops' activities, warranting up to 68 separate blacksmiths' fires being installed, served by an elaborate under-floor flue system.

  The few surviving traditional blacksmiths tools (Group BL) have significance in representing that now almost vanished aspect of the blacksmith's craft. The manual tools are synonymous with blacksmithing in the public's mind, and would have considerable public appeal if demonstrated in a working museum, as complementary to the mechanical blacksmithing methods.

* The dog spike, rivet, nut and bolt line (Group BB) is significant as representing the policy of local self-sufficient manufacture of all basic components. The Ajax dog spike machine (No.594) in particular is significant as having had a busy and productive life for over 70 years, and for being probably the last dog spike machine operating in Australia (as at 1993).

* The Horsfal (Greenwood & Battley) Nut and Bolt Machine (No.224) is significant as the oldest machine of its type at Midland, and possibly the oldest in Australia. It is also significant as the last example at Midland of a machine driven by the original flat belt and lineshaft system which once drove most of the machines in these Workshops, and in all equivalent workshops. With its large flat-belt pulleys, and a built-in system which changes the belt position on the pulleys to stop or start the machine, this also happens to be an excellent machine for demonstrating this power transmission technology.

* Group BH, comprising steam (now air) hammers, and associated dies, tongs, cranes etc., is an excellent example to represent this type of blacksmithing, with hammers ranging from the large and rare 1902 arch hammer (No.226), through several different sizes and types of the more common single sided (clear space) steam hammers, to later electro-pneumatic hammers. This was considered one of the most important forging groups in Australia, according to a Commonwealth survey of manufacturing industry in 1952, and is now possibly the best collection of steam/air hammers in the country.

Groups BB BD BG BH & BL **BLACKSMITHING**

SIGNIFICANCE (Continued)

* The large Tannet & Walker arch hammer (No.226), thought to have worked in its present location continuously since 1902 or 1904, is significant as a rare surviving example of this historically important type of hammer, and probably the oldest and last of its type still in operating order in Australia.

* The drop hammers, Group BD, and associated trimmimg or finning presses, dies and furnaces, are significant as representing about 45 years evolution of this more precise mass-production style of blacksmithing, with one 1911 drop hammer (No.238) and several 1950s hammers, all in working order.

* The Brett Drop Hammer No.238, is significant as a rare example of an early steam-powered drop hammer, with a scientifically important style of steam motor. It is also by far the oldest and largest hammer in the Shop, having operated there for over 80 years, and it is possibly the oldest drop hammer in operation in Australia.

* The Spring Shop equipment, Group BG, although relatively modern (ie. "only" about 40-45 years old) is significant as representing an important but less common aspect of blacksmithing, which has been carried out at Midland since 1904. The existing 1950s equipment is reminiscent of the style of much earlier equipment, and some of it is also significant as examples of presses designed to operate on water hydraulics system (now converted to oil).

* The Blacksmiths Shop as a whole, is significant for combining all of the above, to constitute perhaps Australia's largest and most comprehensive collection of industrial-scale blacksmithing equipment of early to mid 20th century. (A smaller collection of historic blacksmithing equipment which might be comparable with Midland's, possibly still survives at Ipswich Railway Workshops, Queensland.)

Groups BB BD BG BH & BL **BLACKSMITHING**

RECOMMENDATIONS & CONSERVATION POLICY

* Retain the collection of Blacksmiths Shop equipment (Groups BB, BD, BG, BH, BL & BM) in situ in the Blacksmiths Shop, Block 2, and gather to the Blacksmiths Shop related equipment now located elsewhere in the Workshops. Use the equipment for a working museum display of blacksmithing techniques, possibly in conjunction with commercial use.

* As well as the major items of plant identified in the inventory, keep dies, handling aids, small adjusting tools etc., needed to operate the plant. Also keep representative samples of the products of the Blacksmiths Shop, and of the raw materials used by the Blacksmiths.

* Keep small attractive items in secure storage (eg. a strong locked cupboard or room).

* Conserve the earthen portions of floor in the Blacksmiths Shop, and at least some of the ventilation louvres which replaced windows along the south wall of the Shop. If digging the floor for any reason, keep watch for the under-floor brickwork flues which extracted fumes from the numerous individual blacksmiths' fires in the western half of Bay 4. If found, photograph the flues, and preferably leave a portion exposed to view.

* Conserve the signs and gates made in the Blacksmiths Shop, for incorporation in the Shop display.

Group BB **BLACKSMITHING ~ Bolts, Nuts & Dog Spikes**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
224	"Horsfal" NUT & BOLT FORGING MACHINE	46	A	A	W	Y
594	Ajax BOLT & DOG SPIKE FORGING MACHINE	46	A	A	W	Y
594	Ajax BOLT & DOG SPIKE FORGING MACHINE	46	A	A	W	Y
594	DIES for the Ajax DOG SPIKE MACHINE	46	A	A	W	O
597	WAGR FURNACE for Ajax Dog Spike Machine	46	A	A	W	Y
599	Thornley 6-SPINDLE NUT TAPPING MACHINE	46	A	A	W	Y
600	Thornley DOG SPIKE POINTING MACHINE	46	B	A	W	Y
601	McPherson DOG SPIKE FINNING PRESS	46	B	A	W	Y
603	Landis DOUBLE-HEAD SCREWING MACHINE	46	B	A	W	Y
604	McPherson DOG SPIKE FINNING PRESS	46	B	A	W	Y
1848	Covmac No.4 FORGING (HEADING) MACHINE	46	B	A	W	Y
1848	Covmac No.4 FORGING (HEADING) MACHINE	46	B	A	W	Y
1850	Covmac FORGING (HEADING) MACHINE (3.5in)	74	C	C	D	R
1920	WAGR OIL FURNACE for Covmac Machine	46	B	A	W	Y
2502	John Heine INCLINABLE FINNING PRESS	23	C	B	C	O
8014	SPECIAL TROLLEY LINE for Dog Spikes	46	A	A	W	Y
8014	FLAT-BED STEEL TROLLEYS for Dog Spikes	46	A	A	W	P
8014	Bags of Finished DOG SPIKES	46	C	A	S	P
8014	Avery PLATFORM SCALES	46	B	A	W	P
8262	EXPERIMENTAL TWISTED DOG SPIKES	46	B	B		

Group BD **BLACKSMITHING ~ Drop Hammers**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
238	Brett 40-cwt DROP HAMMER	46	A	A	W	Y
238	Brett Drop Hammer STEAM MOTOR	46	A	A	W	Y
1852	Massey 12.5-cwt DROP HAMMER	46	B	A	W	Y
1854	Massey 120-ton FINNING PRESS	46	B	A	W	Y
2064	Massey 20-cwt FRICTION DROP HAMMER	46	B	A	C	Y
2065	Massey 200-ton FINNING PRESS	46	B	A	C	Y
2196	Massey 15-cwt FRICTION DROP HAMMER	46	B	A	C	Y
2198	Massey 120-ton FINNING PRESS	46	B	A	C	Y
3737	FURNACE for Massey 20-cwt Drop Hammer	46	C	A	W	Y
8030	Small 4-wheeled HAND TROLLEY	46	C	A	W	P
8146	FURNACE No.374	46	C	A	W	P
8213	TRIMMING DIES for Forged Components	19	B	A	W	R

Group BH **BLACKSMITHING ~ Steam or Air Hammers**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
65	WAGR Riveted "CIRCULAR" FURNACE No.21	46	A	A	W	Y
70	WAGR Riveted "CIRCULAR" FURNACE No.70	46	A	A	W	Y
226	Tannet Walker 50-cwt ARCH STEAM HAMMER	46	A	A	W	Y
228	Massey single-side 25-cwt STEAM HAMMER	46	A	A	W	Y
242	Tomlinson Bros. hand operated FORGE CRANE	46	A	A	W	Y
243	Tomlinson Bros. hand operated FORGE CRANE	46	A	A	W	Y
247	Davy single-sided 7-cwt STEAM HAMMER & DIES	46	A	A	W	Y
248	Davy single-sided 7-cwt STEAM HAMMER	90	C	B	D	R
248	BASEPLATES for 7-cwt Davy Steam Hammer	90	C	B	D	R
249	Davy single-sided 10-cwt STEAM HAMMER	46	A	A	W	Y
652	Jessop & Appleby 30-cwt HAND CRANE	46	A	A	W	Y
653	Jessop & Appleby 30-cwt HAND CRANE	46	A	A	W	Y
1844	Massey 10-cwt PNEUMATIC HAMMER	90	C	B	D	R
1845	Massey 10-cwt PNEUMATIC HAMMER	46	B	A	W	Y
2200	Small FURNACE	46	C	A	W	P
3403	Fielding & Platt 30-cwt HAND CRANE	46	A	A	W	Y
3742	Small FURNACE	46	C	A	W	Y
3743	Small FURNACE	46	C	A	W	Y
3745	Small FURNACE	46	C	A	W	Y
3746	Small FURNACE	46	C	A	W	Y
8026	TOOLS & DIES for Steam Hammer	19	A	A	W	R
8026	TOOLS & DIES for Steam Hammer	46	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	46	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	46	A	A	W	P

Group BH **BLACKSMITHING ~ Steam or Air Hammers**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8026	TOOLS & DIES for Steam Hammer	46	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	46	A	A	W	R
8026	TOOLS & DIES for Steam Hammer	90	A	A	W	R

Group BL **BLACKSMITHING ~ Traditional**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
508	Alldays & Onions CENTRIFUGAL FAN	46	A	A	W	Y
8013	Blacksmiths HAND SWAGING TOOLS	46	A	A	W	P
8013	Traditional BLACKSMITHS TONGS & ANVIL	59	B	A	W	R
8013	Traditional BLACKSMITHS TONGS & DIES	46	A	A	W	P
8027	CONICAL CAST-IRON MANDREL	46	A	A	W	R
8027	CONICAL CAST-IRON MANDREL	59	A	A	W	R
8035	SPECIAL ANVILS with Flat Top & 2 Square Holes	90	A	A	D	R
8060	Cast Steel SWAGING BLOCKS	24	A	A	W	R
8061	Blacksmiths FULLER or SWAGE HAMMERS	24	A	A	W	R
8105	SWAGING BLOCK & Blacksmiths TOOLS & STAND	46	A	A	W	P
8109	Traditional FORGE, ANVIL & RACK of TONGS	46	A	A	W	Y
8110	Blacksmiths IRON WORK TABLE	46	A	A	W	P
8241	Blacksmiths SQUARE CAST-IRON WORK TABLE	59	A	A	W	R

Group BM **BLACKSMITHING ~ Miscellaneous**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
660	ANNEALING FURNACE	46	B	A	W	Y
3285	Young's 36-cwt DUAL-SPEED HAND WINCH	46	A	A	W	Y
3751	Blacksmiths LARGE FURNACE	46	B	A	W	Y
3759	Blacksmiths LARGE FURNACE	46	B	A	W	Y
8025	TEST ROOM WALL SIGN	54	B	B	D	Y
8025	TWO HANGING SIGNS on BLACKSMITH SHOP	46	A	A	D	Y
8106	TROLLEY SUPPORT on RAILS	46	B	A	W	P
8108	PAIR of "WROUGHT IRON" GATES	46	B	B	D	Y
8216	Marfleet & Weight SMALL FURNACES	46	C	C	O	

Groups BO & BR BOILERMAKING

The Boilermaking Group has been divided into two sub-groups, identified as:

Group BO - GENERAL (CUTTING & SHAPING PLATE, ANGLE-IRON etc)

Group BR - RIVETING (SPECIALISED RIVETING EQUIPMENT)

Group BO BOILERMAKING - General (Cutting & Shaping Plate, Angle-iron etc)

SUMMARY

Originally, Boilermakers literally made boilers for stationary steam engines or locomotives, by cutting and bending heavy steel plate and other steel sections, drilling rivet holes around the edges of the plates, and then riveting the parts together into a closed-end, steam-tight, cylinder or other shape, (see also the section on Group BR - Riveting, below). When Midland Workshops was established, Bays 1 & 2 of Block 2 were dedicated to Boilermaking, and to the Hydraulic Machinery (eg. presses) used to form the plates ready for making into boilers. Although Midland was not planned originally to make locomotives, it was anticipated that many imported locomotives would need to have boilers repaired at Midland, and some new boilers would have to be made locally to replace original boilers too corroded to be repaired. The Boiler Shop was equipped with big overhead travelling cranes able to move large steel plates, heavy steel fabrications, and complete boilers.

From the 1920s, Midland made some complete locomotives, as well as trams or parts for trams, and this involved a lot of boilermaking type of work in manufacturing chassis, bogies etc., as well as the locomotive boilers. The same boilermaking techiques were also used to make other heavy steel structures, (eg. parts of steel bridges, turntables, and heavy-duty steel wagons), and to repair the steel chassis of cars and wagons. When diesel locos replaced steam, and loco boilers were no longer needed, Boilermakers continued to apply their skills and equipment to make or repair these other types of steel (and later aluminium) fabrications, up until the 1993/94 closure of the Shops.

In later years, oxy-cutting and electric arc-welding replaced earlier mechanical cutting and riveting methods, and welded aluminium wagons were made as well as steel ones. Virtually all boilermaking equipment was removed from the Boiler Shop in Bays 1 & 2 of Block 2, and was relocated to the Flanging Shop (originally a Paint Shop, but now with the roof raised and overhead travelling cranes installed).

Group BO BOILERMAKING - General (Cutting & Shaping Plate, Angle-iron etc)

SUMMARY (Continued)

The Flanging Shop equipment includes: old and new heavy 3-roll and 4-roll plate benders, for forming flat steel plate into cylindrical forms (Nos. 275 & 2201); an old Kendall & Gent plate edge planer (No. 273) custom made for W.A.G.R. in 1903 for preparing plate edges for steam-tight riveted joints (and later to prepare plate edges for welding); three large drills (Nos. 279, 1023 & 1207), for drilling bolt holes or rivet holes in plates etc.; and a large cast-iron table (No. 8244) for marking out plates ready for cutting and drilling.

The Flanging Shop has several hydraulic presses and benders for shaping plates and steel sections, including old Henry Berry horizontal and vertical presses (Nos. 251 & 1005, acquired 1901 and 1927 respectively), and a Fielding and Platt 1000 ton force hydraulic plate-forming press (No. 2006, installed 1949) which is reputedly one of the largest in Australia. All of these presses run on high-pressure water from a 1924 Worthington-Simpson pump (No. 585), originally installed in the Powerhouse but now relocated to the east end of the Flanging Shop, and supplying water via a Fielding & Platt accumulator (No. 2076, installed 1949).

The Flanging Shop water-hydraulic system is the remnant of a much more extensive water-hydraulic system which was based in the Powerhouse and served machines in Blocks 2 and 3. The original system, installed c1904, has mostly been removed (some remnants are listed as No. 8185), and all remaining hydraulic machines outside the Flanging Shop have been converted to oil operation. However, the Flanging Shop hydraulic machinery remained in use up to the end of 1993, and is believed to be the last water-hydraulic system operating in Australia, giving it very high (even national) significance.

The Flanging Shop and Boiler Shop (Block 2) have a number of modern machines which add to the boilermaking capacity and completeness, but could hardly be considered heritage items. These include a large guillotine for cutting heavy steel plate (and which presumably replaced an earlier guillotine), oxy-cutting machines for cutting various shapes from steel plate, and semi-automatic welding machines on mobile stands, for welding steel or aluminium wagons. These have current commercial value rather than heritage value - as yet.

Group BR BOILERMAKING - Riveting (Specialised Riveting Equipment)

SUMMARY

The original Boilermaking Shop in Block 2 retains little boilermaking equipment, but does have several significant items of riveting equipment, including a large Tower drill (No.1083) for drilling rivet holes in cylindrical boilers, a rare rivet heater (No.1497), samples of different sized rivets (No. 8101) and relatively modern pneumatic riveting equipment (Nos. 8129 to 8131).

Boilers for locomotives are/were made by joining a number of steel plates together, using steel rivets in drilled holes around the edges of the plates. The plates had to be carefully drilled to get the holes in the overlapping edges of two plates to line up with each other to accept the rivets. Then the rivets had to be very firmly closed together by hammering or squeezing the rivet heads, to get joints that were not only strong but also leak-proof, to contain the high-pressure steam. Even when welding began replacing rivets for general fabrication work, rivets continued to be used for loco boilers because of the unreliability of early welding technology, and the potentially disastrous consequences of boiler failure.

Rivet holes were usually drilled slightly undersize in the separate plates by heavy radial drills (eg. Nos. 279, 1023), then reamed to correct size and alignment when the plates were brought together - originally using hand reamers or files, and later using pneumatic reamers (see No.8129). In 1940 a Kitchen & Wade Tower Drill (No.1083) was installed, to permit more accurate drilling of rivet holes on partially-assembled boilers. That drill is still in situ in the NW corner of Block 2, almost the only old boilermaking equipment left in the Boiler Shop.

Rivets were traditionally "closed" (ie. the second head formed and the joint pulled tight together) by having one man inside the boiler holding a heavy cup-head "dolly" against one end of the rivet while another man outside swung a hammer and struck another cup-head die held against the other end of the rivet. This was hard work and very noisy, inducing the common trait of boilermaker's ear (deafness). It was also very dependent on the skill and energy of the men to get consistently steam-tight joints - a major problem as each boiler would have many hundreds of rivets.

When Midland Workshops was built it was becoming normal for railway workshops to rivet boilers by means of hydraulic gap-riveters, in which the rivet was squeezed tightly between a fixed die and an opposing die mounted on a powerful water-hydraulic ram. This method gave more consistent results, and was much quieter than hammer riveting. The heading dies and the hydraulic ram were mounted on a U-shaped frame which straddled around the part being riveted, and which had to be strong and rigid enough to stop the dies simply pushing apart instead of squashing the rivet. The edge frames of firebox openings or inspection manholes could be riveted by a relatively small gap-riveters, with a throat or gap of (say) 6 inches (150 mm) to close rivets close to the edge of the opening.

Group BR BOILERMAKING - Riveting (Specialised Riveting Equipment)

SUMMARY (Continued)

Very large gap riveters with a throat of say 15-25 feet deep were needed to close rivets at the centre or closed far end of a cylindrical loco boiler. (Newport Railway Workshops, Melbourne, had two hydraulic gap riveters, one with an 18 feet gap, and the other with a 26 feet gap - both recently cut up.) Typically, the gap riveter would be set in a deep pit, with the riveting head at a convenient height a few feet above floor level. A crane high above the riveter would pick up the boiler shell by one end, and lower it vertically over the gap riveter anvil leg, until the holes to be riveted lined up with the fixed die. A rivet would be inserted, then closed by the ram. The boiler would then be repositioned slightly to fit and close the next rivet, and so on.

Although no definite proof (eg. a drawing or plant card) has yet been found to support the theory that Midland Workshops had a gap riveter for making boilers, there is plenty of evidence indicating that a large gap riveter was installed at the eastern end of Bay 2 in the 1902/04 Boiler Shop (ie. in the centre of Bay 2 after the Shop was extended.) There is an overhead short-travel electric crane near the centre of Bay 2, in a special tall clerestory roof section shown on various drawings as the "Rivetting (sic) Tower" (see No.8102). The crane (also listed under No.8102) was made by Oerlikon, has 5 ton and 15 ton hooks, and is noted on the crane records as the "Gap Riveting Crane". The plant card for this Oerlikon crane show it was known as Crane No.6, later changed to Crane No.10, and recently given "DOSHWA" No.B15697.

In the floor beneath the crane there is a evidence of a large hole which has been filled and patched. PWD Drawings of Block 2 "as constructed" c1904 show the crane tower and crane, but show no pit and no riveter. However, a 1911 drainage drawing shows a pit 20 feet deep in the floor beneath the crane, requiring very deep pipes to drain away seepage from the pit.

The 1902 Report of the Select Committee lists two hydraulic riveters to be purchased, one 40 ton and the other 20 ton (mass? or rivet closing force?). The hydraulic plant for Midland Workshops (including riveters ?) was to be supplied by Tannet Walker & Co. Further evidence is found in Plan 783 (dated 1902) showing "Hydraulic Power Required Throughout Workshops - Scheme Y". This shows hydraulic water supply lines to various areas, including the Riveting Tower in Block 2. Plan 1222 (of 1904) shows hydraulic lines to a "Stationary Riveter" in Bay 2 of the Boiler Shop. A 1952 Plan No.11786 shows hydraulic lines to various machines, including a machine, Plant No.274, at about the riveting tower, but no records or plant card have been seen for that machine.

Group BR BOILERMAKING - Riveting (Specialised Riveting Equipment)

SUMMARY (Continued)

Drawing 1527C in CME's strong room, dated 1950, shows a proposed Henry Berry hydraulic gap riveter with 20 foot gap, to operate at 1500 psi, which is a typical water-hydraulic pressure, although water is not specified on the plan. This appears to have been a proposed replacement of an existing gap riveter, which was not proceeded with. Instead, (according to verbal advice from Merv the Boilermaker), a large static iron mandrel was installed in the pit, with a fixed "dolly" die attached. The boiler shell was lowered over the mandrel by the overhead crane and moved to line up one of the rivet holes with the "dolly". A hot rivet was inserted in the hole, and then the rivet closed using a pneumatic rivet gun from outside, working against the inertia of the mandrel on the inside. This was presumably a cheaper option adopted for boiler repair or rebuilding, when riveted boilers were going out of use.

With portable pneumatic rivet guns and dollys (No.8130), work could be done away from the area of the tower, wherever the compressed air supply was available. An innovation which made the riveting location more flexible was the introduction of a mobile rivet heater (No.1497) bought in 1949.

Groups BO & BR BOILERMAKING

SIGNIFICANCE

The Boilermaking equipment, including General Boilermaking and Riveting (Groups BO and BR) is significant for reasons including the following:

* The machines represent the work of the Boilermaking Shop, which was a major part of Midland Workshops activities from the start, and remained so until closure.

* The various massive plate bending and planing machines demonstrate the heavy-duty nature of boilermaking. Several were used for manufacture and repair of loco boilers.

* Several machines, (eg. Pipe Cutting Machine No.46, and Plate Edge Planer No.273), were custom made for WAGR for installation in the new Workshops opened 1904, as evidenced by the "WAGR" and date cast in the frame.

* The Plate Edge Planer (No.273) is a rare machine of impressive scale, made specifically for preparation of plates for riveted boilers (although later also used for preparing plate edges for welding). To our knowledge it is the last of its type still operable, in Australia.

* The several water-powered hydraulic presses in the Flanging Shop (Nos.251, 1005, and 2006) represent the evolution of water-hydraulic presses over half a century, from 1902 to 1949. Together they represent the last presses at Midland still operating on the historically important water-hydraulic system (others here have been converted to oil). They represent 90 years continuous use of water-hydraulic power at Midland Workshops, and to our knowledge are the last industrial presses powered by water to be still operating in Australia.

* The Fielding and Platt 1000 ton Hydraulic Press (No.2006), acquired 1949, is reputed to be the largest such press in Australia. Together with the F & P accumulator (No.2076) also acquired 1949, it is testament to the confidence in water-hydraulics as a viable power source for new machinery up to the mid 20th century. The press and accumulator remained in operation (forming large aluminium plates) up to November 1993, and are fit to continue working in future.

* Forming dies for the 1000 ton hydraulic press (No.2006), now mostly left rusting in the open yard, are significant in representing the scale and nature of work done on the press, and in their potential future use with the press for demonstration and/or contract work.

Groups BO & BR **BOILERMAKING**

SIGNIFICANCE (Continued)

* The unbranded Punch and Shear Machine (No.3113) obtained from Midland Railway Company is significant for its association with that company, and as the only example at Midland of this once widely used type of machine. This machine appears to be very old, and is estimated to date from c1900.

* The riveting equipment (Group BR) represents what was the main industrial method of joining heavy iron components, including boiler plates, water tanks, loco frames, wrought iron bridges, roof trusses etc., during the 18th and 19th centuries, and the first half of the 20th century. Riveting was one of the principal techniques used at Midland Workshops, for the first 50 years of the Workshops. Since about the Second World War, riveting of boilers and of steel fabrications generally, has been superseded by welding. Consequently, industrial riveting equipment is now rare, and although the Midland group is not complete (lacking a gap riveter and lacking manual riveting tools), it is still of very high significance.

* The tower drill (No.1083) is a large sophisticated drilling machine addressing the specific needs of manufacturing riveted cylindrical boilers. It is the main surviving evidence at Midland of the nature and scale of boiler manufacture (apart from some samples of the boilers it helped make), and is evidence of the ongoing importance of boiler making in the 1940s, when this machine was installed. It is now the only boiler making machine still fixed in situ in the Boiler Shop.

* The Riveting Crane (No.8102) is significant both as one of the original Oerlikon electric cranes installed in 1902, and as the main surviving physical evidence of the important boiler riveting machine (not found) which was located in a pit beneath the crane, and which was the focal point of the Boiler Shop for more than 50 years.

* The surviving rivets (No.8101), rivet heater (No.1497), and pneumatic riveting and reaming tools (Nos.8129, 8130, 8131), are significant as the only surviving tools at Midland used for placing and closing rivets, and have considerable potential value for demonstration of the technique.

* The group of handworking boilermaking tools (Nos 8115 and 8132), and the earthen floored area where they are located, are significant as rare surviving representatives of the formerly important manual metal-shaping aspects of this trade, now replaced by mechanical forming or by oxy-cutting and welding. They are particularly evocative of the hard and dirty physical labour of the men involved, and of the close relationship between the fiercely separate Boilermaking and Blacksmithing trades.

Groups BO & BR **BOILERMAKING**

SIGNIFICANCE (Continued)

* The scrap locomotive boilers in the Salvage Yard (No. 8153) are significant as examples of the nature and scale of boilermaking work done in the Midland Boiler Shop, and of the Workshops' long involvement with locomotive construction and repair. The boilers would have considerable value for public display and interpretation of the Workshops' past role.

Groups BO & BR BOILERMAKING

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the Riveting Crane (No.8102) in situ and visible, and preferably in working order. If the Boiler Shop area (Bays 1 & 2 of Block 2) is adapted to other uses, the crane is high enough to cause no interference.

* Conserve the hydraulic presses (Nos.251, 1005, 2006) and associated dies, the plate furnaces (Nos.616, 2075), the plate handling charger (No.2007) (and the associated pump, accumulator, pipework etc., in Group HY), as an operating entity capable of undertaking future demonstration and/or contract work.

* Conserve the more historically significant plate forming and preparation machines now in the Flanging Shop (Nos.273, 275, 2201, 8244), for demonstration and/or ongoing contract use.

* Relocate the very old Punch and Shear Machine (No.3113) and the younger Lindemann Shearing Machine (No.2504) from the Salvage Yard to the Flanging Shop, for incorporation in a display of boilermaking machinery.

* Consider keeping additional non-heritage machines (eg. modern plate guillotine, plate brake press bender, flame cutters, semi-automatic welding machines, etc.), to maintain operational viability of the Flanging and Boilermaking Shop to undertake future commercial work.

* Keep the overhead cranes which serve these conserved machines, to enable the machines to continue to function.

* Conserve the manual boilermaking tools (Nos.8028, 8115, 8132) in situ as a group, for demonstration. Keep the existing earthen floor in their vicinity, for authenticity and to demonstrate what the main part of the boilermaking shop was originally like.

* Collect the various scattered boilermaking tools and dies (Nos.46, 400, 1497, 2006 (dies), 2504, 3113, 8062, 8101, 8129, 8130, 8131), and relocate them to the Flanging Shop, for demonstration and/or commercial use in conjunction with the other boilermaking machinery already there.

* Keep the small portable boilermaking tools in a secure storage, to prevent theft or unintentional disposal.

Groups BO & BR **BOILERMAKING**

RECOMMENDATIONS & CONSERVATION POLICY (Continued)

* Conserve the Tower Drill (No.1083) in situ (in the far north-west corner of Bay 1, Block 2), together with associated drill bits etc. This machine could still be used for contract work, to drill precisely placed holes in large cylindrical shells or similar fabrications, but it seems unlikely to have ongoing use unless given dummy tasks for demonstration. A large part of this machine is set below floor level, and it would be difficult and expensive to move. It makes an impressive piece of indoor sculpture, symbolic of the former function of this area, and could be left in situ without unduly disrupting the use of the rest of the former Boiler Shop.

Group BO **BOILERMAKING ~ General**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
46	Kendall & Gent PIPE-CUTTING MACHINE	47	A	A	W	R
46	Kendall & Gent PIPE-CUTTING MACHINE	47	A	A	W	R
251	Henry Berry BENDING & STRAIGHTENING PRESS	52	A	A	W	P
273	Kendall & Gent PLATE EDGE PLANER	52	A	A	W	Y
273	Kendall & Gent PLATE EDGE PLANER	52	A	A	W	Y
275	Smith Bros. 4-roll PLATE BENDING ROLLS	52	A	A	W	Y
400	Fielding & Platt HYDRAULIC BENDER	26	A	B	W	R
616	WAGR PLATE FURNACE for Hydraulic Press	52	A	A	W	Y
1005	Henry Berry VERTICAL HYDRAULIC PRESS	52	A	A	W	P
1090	"Mammoth" FLAT-BAR BENDER	52	B	A	W	R
2006	Fielding 1000-ton HYDRAULIC FLANGING PRESS	52	A	A	W	Y
2006	DIES & COMPONENTS for Fielding 1000-ton Press	90	B	A	W	R
2007	J. Booth 1.5-ton TRAVELLING FURNACE CHARGER	52	B	A	W	Y
2075	LARGE PLATE FURNACE for the 1000-ton Press	52	B	A	W	Y
2201	James Bennie 3-roll PLATE BENDING ROLLS	52	B	A	W	Y
2504	Lindemann of Dusseldorf SHEARING MACHINE	74	B	A	W	R
3113	PUNCH & SHEAR MACHINE	74	A	A	W	R
8028	CIRCULAR CAST-IRON FORMING TABLE	52	A	A	W	Y
8062	Boilermakers FLANGING or DRAWING DIES	24	B	A	W	R
8103	STEEL SIGN - Apprentice School	46	C	B	D	R
8115	Boilermakers HAND-WORKING EQUIPMENT GROUP	52	A	A	W	Y
8132	Boilermaker/Blacksmith HAND TOOLS COLLECTION	52	A	A	D	R
8153	LOCOMOTIVE BOILER	74	A	A	D	R
8244	Large CAST-IRON MARKING-OUT TABLE	52	A	A	W	Y

Group BR **BOILERMAKING ~ Riveting**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1083	Kitchen & Wade TOWER DRILL	46	A	A	W	Y
1497	Martin MOBILE ELECTRIC RIVET HEATER	47	A	A	W	R
8101	Collection of RIVETS	46	A	A	D	O
8102	GAP RIVETER CRANE TOWER in Boiler Shop Roof	46	A	A	D	Y
8102	Oerlikon 15-ton OVERHEAD TRAVELLING CRANE	46	A	A	D	Y
8129	Ingersoll-Rand PNEUMATIC REAMERS	46	B	A	W	R
8130	PNEUMATIC RIVET GUN, PNEUMATIC DOLLY & DIES	46	B	A	W	R
8131	PNEUMATIC RIVET BUSTER with PUNCH & CHISEL	46	B	A	W	R

Group BU BUILDINGS & BUILDING DETAILS

SUMMARY

This inventory is concerned with Workshops plant and artefacts. The Workshops buildings are reported on separately, in the Conservation Policy written by The Heritage and Conservation Professionals (HCP). However it should not be forgotten that the main buildings at Midland are themselves industrial artefacts, in that their industrial purpose is built into their design.

This plant inventory does include a few building details which are considered to be industrial artefacts themselves, or which provide evidence of former plant since removed. Some are listed under Group BU (Buildings), while others are listed under Group LS (Lineshaft Remnants), Group MH (Materials Handling), Group UT (Utilities) and Group WO (Woodworking).

The general Building Details Inventory, Group BU, includes items such as ripple-iron and later steel-slat roller shutter doors (both as No.8190), cable guides and ceramic insulators for former electrical supplies (No.8186), circuit-breaker cubicles in the Substation (No.8113), locomotive inspection pits (No.8255) and sub-floor structures in the Powerhouse and Boilerhouse (No.8257).

Typical building details listed in the Lineshaft Group are bolt holes and brackets, attached brick piers in the west end wall of Block 3, and a solitary bottom half of a plummer block, also in the end wall of Block 3. These minimal fragments of a once mighty system are all listed as No.8029.

Building details included in the Materials Handling Group are trolley lines and turntables, particularly those in the Wood Mill (No.8012), the structural supports (crane beams & columns or piers) of various listed cranes, the remnants of the former coal and ash handling system in the Boilerhouse (No.8155), and the sets of dual-gauge turntables and rail lines in the floor of the Wheel Shop (No.8191).

Utilities such as the reticulated steam system have left traces in the form of steam-pipe brackets (No.8069). The sawdust collection system is built in to Block 1, and is listed as both Utilities (the "Cyclones") and Woodworking (the fans & ducts). It includes tunnels and ducts under the Wood Mill floor (No.8021), cupboards containing the Sturtevant fans (No.1019 et al), and the infrastructure for the "Cyclones" (No.8090) and for an overhead Sturtevant fan (No.1965).

Most of these building details are of high significance due to their ability to assist the interpretation and visualisation of the former equipment and operation of the Workshops. Some, such as the sawdust collection structures, should be capable of continued use in a working museum environment.

Group BU BUILDINGS & BUILDING DETAILS

SIGNIFICANCE

Items related to Buildings, or Building Details (Group BU), are significant for reasons including the following:

* The roller shutter doors (No.8190) are early examples of their type, and demonstrate the then rapidly changing technology from continuous ripple-iron to separate slat construction in just a few years. The ripple-iron type are now rare.

* The electrical insulators (No.8186) are indicative of the early electrical power distribution technology, and a reminder that Midland was one of the earliest major Australian workshops to be designed with electricity rather than steam as the principal power supply to machinery.

* The sub-floor structures of the Powerhouse and Boiler House (No.8257), if they still exist, are significant as the main physical evidence (other than the buildings) of the original power generation system central to the establishment of Midland Workshops as a self-sufficient electric-powered workshop. The sub-floor structures might also reveal significant technical information about the boilers, generators and other plant originally in the Boiler House and/or Powerhouse, not available from surviving documents.

* The locomotive inspection pits (No.8255) in Block 3, the corresponding car & wagon inspection pits in Block 1, and the network of yard railway tracks interconnecting the pits to the rest of the Shops (No.8261), are significant in clearly indicating the basic reason for Midland Workshop's existence, ie. the construction and maintenance of railway rolling stock.

Group BU **BUILDINGS & BUILDING DETAILS**

RECOMMENDATIONS & CONSERVATION POLICY

* Samples of the original roller shutter doors (No.8190) should be conserved as interesting building artefacts, preferably in situ. If they must be removed for some substantial reason, then samples (ie. complete doors) should be kept somewhere on site and/or donated to a museum or college of architecture and building.

* The electrical insulators and guides (No.8186, and elsewhere) should be conserved in situ, and left visible, with interpretative explanation of their age and role.

* At least some of the in-floor inspection pits (and the interconnecting rail system) should be conserved in situ and left visible to aid interpretative display of the Workshops' former role. They might also have ongoing use, for service of historic or current rolling stock, especially if the corresponding overhead cranes are also left in situ.

* The sub-floor structures of the Boiler House and Power House (if they still exist) should be investigated and recorded to provide more information about the original Power House equipment, if and when the opportunity arises. The partial exposure of the sub-floor for display and interpretation should be considered.

Group BU **BUILDINGS & BUILDING DETAILS**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8113	CIRCUIT BREAKER CUBICLES	82	C		S	Y
8155	Former COAL & ASH CONVEYOR DOORWAY	23	B		D	Y
8155	RIVETED STEEL FRAME for Coal Bunkers	23	B		D	Y
8186	CERAMIC INSULATORS & WOOD CABLE GUIDE	45	B	A	S	Y
8186	CERAMIC INSULATORS for 1904 Crane Power Wires	47	B		D	Y
8190	Clark Bunnet RIPPLE-IRON ROLLER SHUTTER	45	A	A	S	Y
8190	Kinnear STEEL-SLAT ROLLER SHUTTER DOOR	47	A	A	S	Y
8251	CHIMNEY RECESS & UNDERFLOOR FLUES	46	B	B	D	Y
8253	STEEL DOOR to MAIN STORE	43	B	B	P	Y
8254	STEEL ROLLER OVER DOOR FRAME	45	B	B	S	Y
8255	INSPECTION PITS	45	A	A	W	Y
8256	SUPERVISOR'S OFFICE	45	A	A	W	Y
8257	SUB-FLOOR STRUCTURES - POWERHOUSE	22	B	B	D	Y
8257	SUB-FLOOR STRUCTURES - BOILERHOUSE	23	B	B	D	Y

Group EL ELECTRICAL, ELECTRONIC (Electrical Trades, Devices & Components)

SUMMARY

The first WAGR workshops established at Midland Junction was the Electrical Engineer's Offices and Electrical Workshops (including telegraph and signalling). In 1897 these were moved into temporary buildings at Midland, somewhere near the present signals and communications building north-west of the Institutue. Those temporary buildings have long since been demolished.

Midland Workshops proper had an Electrical Workshop concerned with wiring, switchgear and repair of the power generating equipment, and repair or rewinding of the various electrical motors driving machinery. The Electrical Section was also concerned with electric lighting of the Workshops, with internal telephones, with maintenance of electrical and pressure gauges and similar instruments, and with maintenance of clocks & watches. Later they were involved in the electric lighting of carriages, and much later, with the development and maintenance of electronic devices.

Very little historical equipment related to the activities of the Electrical Shop has survived. Due to the rapidly changing nature and standard of electronic devices and electrical instruments, most early electrical workshops equipment has been discarded as obsolete, especially during the recent Quality Assurance clean-out. Some was donated to A.R.H.S. or similar bodies. Useful modern electrical workshop equipment has been transferred to other railway workshops or depots. Consequently little equipment was found in the Electrical Workshops when inspected in 1993, and little is listed here under Group EL. A few items of equipment found in the Electrical Shops were related to instrument and clock repair, and are listed under Group IN, Instruments.

Some old electrical control cabinets, switchgear, motors etc., which served specific Workshop machines are listed in the Inventory with those machines. However, a few miscellaneous items of electrical equipment not specific to other groups have been listed here under Group EL. These include a couple of AC-DC rotary converters (Nos. 194 & 8245), an L.D.C. electric motor (No.8206) which probably belonged to some large machine now removed, a small mobile electric welder (No.3255), forgotten in a shed, and a very early lathe, modified for coil winding (No.550).

The upper levels of the Substation on the eastern side of the Power House are crammed with shelves, mostly stacked with what looks like obsolete electrical gear and light fittings. Some shelves have rows of old electrical meters (No.8084). These are thought to be from the original power generation plant, but it was not possible to verify this. It will be necessary to sort through and identify significant items amongst all the electrical equipment in the Substation.

Group EL ELECTRICAL, ELECTRONIC (Electrical Trades, Devices & Components)

SIGNIFICANCE

Items related to the Electrical Trades, and Electrical Devices and Components (Group EL), are significant for reasons including the following:

* Some of the the electrical meters in the Substation store may be from the original 1904 Power House switchboard, and if so are of very high significance as the only plant items surviving from Midland's own power generation period.

* The mobile welder (No.3255) is significant as a now-rare example of a type of welder once commonly used in the Workshops, and in industry generally.

* The two AC/DC Rotary Converters (Nos.194, 8245) are significant as relatively early examples of electrical devices to produce DC current from AC power, using the then best available technology of coupled motor-generator sets (nowdays achieved by solid-state rectifiers). No.194 is possibly the oldest electrical device still operating in the Workshops.

* The Selig Sonnenthal Screwcutting Lathe (No.550), acquired 1898 but later heavily modified as a coil winder, has some significance as the remnants of the oldest metal cutting machine tool at Midland, and as the only Electrical Workshop machine of any historical consequence that was found.

Group EL ELECTRICAL, ELECTRONIC (Electrical Trades, Devices & Components)

RECOMMENDATIONS & CONSERVATION POLICY

* The historically significant Electrical Shop equipment is so sparse, that a museum display of the Electrical Shop as such is not feasible. However, the significant items of electrical equipment listed in the Inventory should be conserved for display either as miscellaneous items of electrical machinery, or in conjunction with the other major trade groups to which they relate.

* The electric welder (No.3255) should be displayed in conjunction with the Boiler Shop equipment (located in the Flanging Shop), where it could be used to illustrate the evolution of boilermaking processes from riveting to welding.

* The electrical meters and similar devices in storage in the Substation building should be individually identified, to determine their origin. If any are from the 1904 Power House installation, they should be conserved for display in the Power House, and possibly for use in construction of a partial replica of a 1904 switchboard panel.

* The two AC/DC Rotary Converters (Nos.194 & 8245), with associated controls and meters, should be conserved for eventual display at Midland, but in a place and context still to be determined.

* Conserve the Selig Sonenthal Lathe for eventual display as a coil winding machine, in a location to be determined. There is now no possibility of restoring it back to its original lathe configuration.

Group EL **ELECTRICAL , ELECTRONIC**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
194	Metropolitan-Vickers AC-DC ROTARY CONVERTER	45	A	A	W	O
550	Selig Sonnenthal SCREW-CUTTING LATHE	32	B	B	D	R
3255	EMF MOBILE ELECTRIC WELDER	32	B	A	D	R
8084	OLD ELECTRICAL METERS	82	A	A	D	O
8206	Lancashire Dynamo Crypto ELECTRIC MOTOR	45	?	?	H	?
8211	Lancashire Dynamo Crypto ELECTRIC MOTOR	90	C	B	D	R
8245	Canning AC-DC ROTARY CONVERTER & CONTROLS	31	B	B	D	R

Groups FF, FM & FN FOUNDRY

The Foundry Group has been divided into three sub-groups, identified as:

Group FM - MOULDS & MOULDMAKING (FERROUS or NON-FERROUS)

Group FF - FERROUS CASTING

Group FN - NON-FERROUS CASTING

SUMMARY

The Foundry (Building No.14) was one of the first of the Midland Workshops buildings to be erected. It catered for both ferrous and non-ferrous work, making iron castings for rolling stock or per-way use, brass handles and fittings for carriages, and plain brass or "white-metal" bearings for carriage, wagon and loco axles. The foundry also melted and recovered scrap non-ferrous metals from worn bearings etc.

To accommodate the hot, heavy and dirty work, the Foundry building was made with high monitor-style ventilated roof, and with overhead travelling cranes to handle ladles of molten iron. Most of the Foundry has an earthen floor, which absorbs the large amount of spilled moulding sand, and also absorbs splashes of molten metal which would otherwise bounce dangerously on a hard concrete floor, or even "explode" on a wet concrete floor.

Foundry equipment is exposed to a lot of grit and to great changes in temperature, which tends to wear out the equipment rapidly. Consequently, foundry equipment does not generally have a long life, and it is not surprising to find that although the Midland Foundry has been in operation for 90 years, most of the equipment is less than 50 years old.

The 1993 Midland Foundry equipment represents a comprehensive group of mainly c1940s and 1950s technology, with some remnants of earlier technology as well. It was probably the oldest large-scale foundry still in operation in Australia - particularly the electric furnace section. It is recommended that the Foundry equipment, including various scattered smaller items, be conserved as a working museum, and possibly for small-scale operation for commercial, educational or pilot plant use. The iron cupolas and electric furnaces are fixed in position, but it should be feasible to relocate the other items to consolidate the area occupied.

Group FM FOUNDRY MOULDING

SUMMARY

The first steps in casting objects in the foundry is to make the moulds. This is termed Moulding, and is done by Moulders. The Moulders prepare moulding sand, press the sand into moulding boxes around a wooden pattern (see Patternmaking, Group WP), and then separate the pattern from the sand. The treated and compacted sand becomes sufficiently solid to retain a hollow in the shape of the pattern, and hence of the product to be cast. Each mould generally consists of at least two such sand-filled moulding boxes clamped together face-to-face to form one enclosed moulding cavity in the shape of the solid object to be cast. Often an additional piece of shaped sand (a "core") is inserted into the cavity to occupy part of the space and form a hollow casting (inventory items 8218 and 8221 show stages of these processes).

Sand preparation was done by crushing sand in a pan mixer or rumbler (No.2413) to remove lumps and foreign matter, and to mix in stabilising chemicals. Today sand is usually crushed and dosed in a modern automated sand conditioning plant (Nos. 2045 to 2058).

Originally the Moulders pressed the sand manually, but from c1911 they began using moulding machines which had a pneumatic ram to squeeze the sand against the pattern. In 1993 many old-style moulding machines were still in use, most of them apparently made c1930 in the Workshops (Nos. 640, 641, 645) as copies of a commercial machine (No.496).

Typically, moulders would prepare say 5, 10, 50 or 100 identical moulds from the same pattern, ready to cast the required number of finished products (with a few spares). If necessary, the moulds would be baked in an oven to pre-dry the sand, especially the cores which, if damp, could generate steam and cause the molten metal to explode. At the west end of the Foundry is a very large (19ft x 10ft) core oven with a rolling table & hot air furnace (No.1916).

Group FF FERROUS METAL CASTING

SUMMARY

Cast-iron "pigs" (ingots) were bought in from an iron smelter, and were remelted at Midland in one of several very hot coke-fired cupolas. The first two cupolas were installed in 1915, with a third added sometime later. These were in use until 1946 and 1951, when they were replaced by the two cupolas still in the Foundry (No.1447 in 1946 and No.1637 in 1951). Both cupolas appear to be in working order, and at least one appears to have continued in use up to late 1993.

These cupolas are used for melting common "grey" grades of cast-iron. Pigs of iron mixed with coke are hoisted and charged into the top of the cupolas, and melted in the body of the cupolas. The molten iron is tapped off from an opening at the bottom of the cupolas, and collected in a "ladle", ie. a large iron pot lined with fireclay (No.3842). The ladle is then taken to the casting area, where a little of the molten iron is poured from the ladle into each prepared sand mould.

Two electric-arc furnaces were installed in 1946 (Plant Nos.1315 & 1316), to melt special grades of iron or steel under more controlled conditions than the cupolas could provide. The electric furnaces also remained in use to 1993, their last job being to cast wear-resistant manganese-steel components for rail line crossings. These were not the first such electric furnaces installed in Australia, but by 1993 they were probably the oldest ones still operating. Although smaller and less efficient than modern large-scale electric furnaces, they would still be suitable for small jobs, or for experimental pilot-plant operation to test new casting designs or new alloys, or for demonstration use (more so than larger modern ones).

After the iron or steel casting from either the electric furnaces or cupolas had cooled and solidified, the sand mould surrounding the casting used to be broken away manually. This was often done by putting the casting on a grid-top knock-out table, so that the sand could break up and fall through the grid, leaving the casting sitting on top. By 1993 a mechanical rumbler was used to remove the sand, and several knock-out tables had been dumped in the yard near Salvage (No.8259). Some of the knock-out tables should be returned to the Foundry for display of this older technique.

Group FN FOUNDRY - Non-Ferrous Casting

SUMMARY

Moulds for non-ferrous castings are prepared in the same way as for ferrous, but the metal (usually brass or aluminium) is melted in smaller, lower temperature furnaces, located in an annexe along the north wall of the Foundry. Although Midland Foundry has always had a non-ferrous section, for making axle bearings, carriage handles etc., most of the present non-ferrous furnaces are fairly modern. However, there is one old non-ferrous furnace (Plant No.1318), which was made in the Workshops in 1921, for recovering valuable "white metal" from old-style axle bearings. It remained in service until a few years ago, when white metal bearings ceased to be used.

Groups FF, FM & FN **FOUNDRY**

SIGNIFICANCE

Items related to Foundry Moulding, Ferrous Casting or Non-ferrous Casting (Groups FM, FF & FN), are significant for reasons including the following:

* The Foundry as a whole is significant as one of the original main 1904 metal-working Shops, which has continued in operation to the present day, although its equipment and to some extent its role has changed since 1904.

* The two coke-fired Cupolas (Nos.1447 & 1637), and associated ladles (Nos.3840-3843, 8217, 8223) are good representatives of the most basic type of iron foundry furnace, which has been used for centuries in foundries making common grey-iron castings. These particular cupolas were successfully designed and built by Midland Workshops, and have given more than 40 years of arduous service.

* The electric-arc steel-melting furnaces (Nos.1315 and 1316) and associated charging bucket (No.8222) and ladles (No.3838 etc.) are early examples (but not the first) installed in Australia, and are probably the oldest such furnaces surviving in Australia.

* The moulding machines (Nos.496, 640, 641, 645, etc.) and associated moulding boxes, etc., represent mould-making practices little changed since the 1930s, and rarely found elsewhere today. Most of the moulding machines (and probably the iron moulding boxes), are themselves products of the Midland Workshops, and many of their components were made in the Foundry.

* The surviving sample sand moulds (No.8221), although obviously recent, have significance in representing the many thousands of moulds made, used and necessarily destroyed during the life of the Foundry. They also have high value as interpretative aids, adding meaning to any future display of the foundry equipment.

* The white-metal furnace (No.1318) represents a formerly important aspect of the Foundry, in making and reclaiming non-ferrous bearings for locomotives, carriages and wagons.

* The Elements Shop non-ferrous casting equipment (Nos.8054, 8055, 8056) represent small-scale mixing and casting of non-ferrous metals, but as alloys for soldering or remelting, rather than as end-use castings.

Groups FF, FM & FN **FOUNDRY**

SIGNIFICANCE (Continued)

* If the original knock-out tables are returned, the Midland Foundry will represent a remarkably intact 1940s state-of-the-art ferrous foundry, with coke-fired cupolas for ordinary grey cast-iron, and electric arc furnaces for high-grade cast steels.

* With relatively small electric and coke furnaces by modern standards, and being housed in a large building with clear spaces around, the Foundry is significant in offering an excellent facility (probably the best in Australia) for displaying and interpreting the mould making and casting practices of early to mid-20th century, and especially ferrous casting.

Groups FF, FM & FN **FOUNDRY**

RECOMMENDATIONS & CONSERVATION POLICY

It is recommended that the Foundry equipment, including various scattered smaller items, be conserved as a working museum, and possibly for small-scale operation for commercial, educational or pilot plant use. The iron cupolas and electric furnaces are fixed in position, but it should be feasible to relocate the other items to consolidate the area occupied.

* Conserve the cupolas, electric furnaces and associated ferrous foundry equipment (eg ladles), for working display and possibly for continuing commercial or experimental use. This would also require conservation of the overhead crane, the furnace power supply, and similar support infrastructure.

* Collect the knock-out boxes, the cast-iron moulding boxes, the riveted ladle(s), and the solitary ingot of pig iron, now dispersed outdoors around the Foundry or in the Yard, and store them in the Foundry for conservation and display.

* Conserve the wood and iron moulding boxes, the several moulding machines (Nos.496 etc), and sample patterns and sand moulds, for working or static display.

* Conserve the white metal furnace (No.1318) as representing the older-style non-ferrous foundry equipment, and representing the Foundry's role in making and reclaiming the plain metal bearings universally used on rolling stock axles until the recent advent of roller bearings.

* Consider conserving the more modern non-ferrous foundry apparatus, the modern sand treatment and rumbling plants, and the modern annealing furnace, to supplement the more historic foundry equipment in display and to help attract commercial foundry work.

* Keep (or return to the Foundry) at least sample quantities of moulding sand, coke, pig-iron ingots, steel scrap for melting, alloying materials, and so on, for use in display. Obtain larger quantities if the Foundry is to be used commercially.

* Keep samples of Foundry products for display, preferably in as-cast condition (ie before runners and sprues are removed, working surfaces machined, etc.), or in both as-cast and as-finished condition.

Group FF **FOUNDRY ~ FERROUS CASTING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1315	Birlec-Lectromelt 2-ton ELECTRIC FURNACE	14	A	A	W	Y
1315	English Elec. CONTROL PANEL for 2-ton Furnace	14	A	A	W	Y
1316	Birlec-Lectromelt 3.25-ton ELECTRIC FURNACE	14	A	A	W	Y
1316	English El. CONTROL PANEL for 3.25ton Furnace	14	A	A	W	Y
1396	WAGR "WAGON BOTTOM" ANNEALING FURNACE	14	B	B	W	Y
1447	WAGR made (EAST) CUPOLA BLAST FURNACE	14	A	A	W	Y
1637	WAGR made (WEST) CUPOLA BLAST FURNACE	14	A	A	W	Y
1637	TAPPING CHANNEL for (WEST) CUPOLA	14	A	A	W	Y
3108	WAGR made ANNEALING FURNACE in Shed	7	C	-	-	-
3838	POURING LADLES for the Birlec Furnaces	14	B	A	W	O
3838	Detail of a Birlec Furnace POURING LADLE	14	B	A	W	O
3842	POURING LADLE for the CUPOLAS	14	B	A	W	O
8002	PIG-IRON INGOT	90	A	A	D	R
8217	RIVETED STEEL LADLE with Fireclay Lining	14	A	A	D	R
8222	CHARGING BUCKET, RAILS & WEIGHBRIDGE	14	B	A	W	Y
8222	TROLLEY LINE & SCRAP BINS for Charging Bucket	14	B	B	Y	W
8223	SMALL PIVOTED POURING LADLE on a TROLLEY	14	B	A	W	P
8226	FIRECLAY FURNACE-LID FRAME	14	B	A	W	O
8259	KNOCK-OUT TABLE (Large) for Foundry Castings	90	A	A	W	R
8259	KNOCK-OUT TABLE (Small) for Foundry Castings	90	A	A	W	R

Group FM **FOUNDRY ~ MOULDS & MOULDMAKING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
496	Hodgson Hartley MOULDING MACHINE	14	A	A	W	O
640	WAGR made MOULDING MACHINE	14	C	B	D	R
641	WAGR made MOULDING MACHINE	14	A	A	S	P
645	WAGR made MOULDING MACHINE	14	A	A	S	P
1916	WAGR made CORE OVEN with HOT AIR FURNACE	14	C	B	O	
2045	SAND CONDITIONING PLANT	14	C	B	C	F
2413	WAGR made MOULDING-SAND PAN MILL	14	C	B	W	O
8212	SAND TREATMENT MACHINE	14	C	B	W	O
8218	FOUNDRY MOULDING BOXES	14	A	A	D	R
8219	INGOT MOULDS for the Cupolas	14	B	A	W	O
8220	Buffalo Forge BAR CUTTER or SHEARS (Model 2)	14	A	A	W	P
8221	PREPARED MOULDS with CORES	14	B	A	S	P
8221	WOOD MOULDING BOX & PATTERN	14	B	A	S	P
8224	ROLLER CONVEYORS for Foundry Moulds	14	C	B	S	P

Group FN **FOUNDRY ~ NON -FERROUS CASTING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1318	WAGR made WHITE-METAL FURNACE (No.58)	14	A	A	W	P
8054	MOULDS for NON-FERROUS INGOT CASTING	26	B	A	W	R
8055	LADLES & POTS for NON-FERROUS CASTING	26	B	A	W	R
8056	Collection of TONGS for Non-Ferrous Casting	26	B	A	W	R
8230	ALUMINIUM CASTINGS on Pallets	14	C	B	S	O
8231	NON-FERROUS FOUNDRY FURNACES	14	B	A	W	P

Group FU FURNITURE

SUMMARY

Group FU is nominally for furniture, but as well as desks and cupboards the list includes noticeboards, war memorial honour rolls, and similar building fittings. Rather than an integrated trade group, it is an ad hoc collection of random items scattered throughout the Workshops, with only the honour rolls forming a coherent sub-group. These items relate mainly to the people who worked at Midland rather than to the industrial processes, but are still of industrial heritage significance, and would contribute to the ambience and interpretative value of the Workshops as a working museum.

Group FU **FURNITURE**

SIGNIFICANCE

Items of Furniture, or Building Fittings (Group FU), as listed in the Inventory, are significant for reasons including the following:

* The World War One & Two Honour Rolls represent the patriotism felt here (and in other similar establishments) among the men who enlisted and faced death for King and Country, and the gratitude of those who stayed behind. The individual Memorials for each Shop and trade also signify the way the men in each Shop considered themselves as a separate community within the Workshops.

* The various wooden cupboards, supervisors desks, etc., typify the style of amenities when the Workshops was established, and help keep in mind the people who worked here. The several makeshift cupboards made from tin cans etc., indicate resourcefulness, and possibly war time shortage of materials.

* The elaborate semi-circular desks for the Works Manager and C.M.E. indicate the prestige accorded to those positions of authority. They are significant for having been used by the two officers who had most control of the operation and development of the Workshops since 1920.

Group FU **FURNITURE**

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve and display the War Memorials related to Workshops employees, on the Workshops site. A suitable location, where the memorials could be conserved and protected, could be a proposed Museum of Workshops History and People (see the Overall Recommendations & Conservation Policy).

* Memorials related to railways staff in general, but not specifically to the Workshops could be moved to another site associated with railway employees, eg. Westrail head office, or a major branch of the Railway Institute. In the interim, exposed Memorials (eg those on the outer east wall of the C.M.E.'s Office) should be moved to a safe storage, with identification as to where they came from.

* Keep the C.M.E.'s and Works Manager's desks, and samples of other desks, workbenches, cupboards etc., for display as part of a Workshops Museum.

Group FU **FURNITURE**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8075	POWERHOUSE TOOL CUPBOARDS	22	A		S	P
8078	POWERHOUSE FOREMAN'S DESK	22	A		D	P
8079	SOUND-PROOFED TELEPHONE BOOTH	22	B		W	Y
8079	Telephone Booth detail - DOOR HANDLE	22	B		W	Y
8082	WORLD WAR 1 HONOUR BOARD (Auditor Branch)	9	A	A	D	O
8082	WORLD WAR 1 HONOUR BOARD (Boiler Shop Roll)	64	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (CME Branch)	1	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (Mount for Photos)	64	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (Stores Branch)	1	A	A	D	O
8082	WORLD WAR 1 HONOUR BOARD (Traffic Branch ?)	64	A	A	D	R
8091	PAINTED TOOL CUPBOARD (Apprentice names)	29	B		D	O
8091	PAINTED TOOL CUPBOARD (with Loco numbers)	29	B		D	O
8144	SEM-CIRCULAR DESKS	9	A		W	R
8182	OFFICE DESK (in Toolroom Store)	45	C	B	W	O
8184	CHEST OF DRAWERS (riveted steel drawers)	45	B		W	O
8203	CANE RUBBISH BASKET (Typical Example)	45	B		S	O

Group HY HYDRAULIC POWER SUPPLY (High Pressure Water)

SUMMARY

Water-hydraulic machinery was widely used in heavy industry, railway workshops, dockyards etc., in the late 19th and early 20th century, to drive presses, hoists, cranes, goods and passenger lifts, and so on. However, water-hydraulics gave way to oil-hydraulic systems in the second half of the 20th century, when better oil seals allowed the use of corrosion-inhibiting oil at higher pressures than water, and hence allowed compact oil cylinders to develop the same force as larger water cylinders. Ironically, the latest trend in large industrial hydraulic installations is to go back to using water as a safe non-flammable, non-toxic hydraulic fluid, but with the addition of a small percentage of oil for its lubrication and anti-corrosion properties.

Midland Workshops, like other large workshops of the period, had a reticulated supply of high pressure water at nominal 1500 psi, to drive the various hydraulic machines. (This is at least ten times normal compressed air pressure or domestic water supply pressure, but only about half or quarter of the pressure of modern self-contained oil-hydraulic machines.) The hydraulic water supply at Midland was originally generated by a pump in the NE part of the 1904 Powerhouse, and was stored in two hydraulic accumulators (high pressure storage devices) outside the east wall of the Powerhouse.

The high-pressure water was supplied to metal-forming presses, wheel stripping presses, hoists, hydraulic riveters, etc. in various Shops, via pipes made of thick-walled steel tubing joined by massive bolted flanges. Used water discharged at low pressure from the presses was probably returned by drains to the central pump, but this is not clear from the records.

According to the 1902 Select Committee Report, hydraulic plant and hydraulic cranes were supposed to be supplied by Tannet, Walker & Co. (who also supplied the 3-throw blowing engine still in the Powerhouse today, and the big arch hammer in the Blacksmith Shop). However, several early drawings, including some drawings signed by the W.A. Agent General in England in 1903, refer to an accumulator made by Fielding & Platt. As Fielding & Platt were renowned as makers of high quality water hydraulic machinery, it seems likely that they supplied the accumulators, and possibly the pumps and riveter as well. They certainly supplied the c1902 hydraulic pipe bender (No.400) now near the Elements Shop.

In 1923/24, two electric-drive 3-throw Worthington Simpson hydraulic pumps (Plant Nos.585 & 586) were installed in the Powerhouse, in the place of the then recently removed generators, and presumably also replacing the c1904 pump.

Group HY **HYDRAULIC POWER SUPPLY (High Pressure Water)**

SUMMARY (Continued)

The Worthingtons supplied the workshop presses etc., via reticulation pipes, until about 1952 or 1954. Then the Boiler Shop hydraulic machinery was relocated from Block 2 to the Flanging Shop, which was the former (second) Paint Shop but with roof raised and overhead cranes installed. One of the Worthington pumps (No.585) was relocated to a small shed at the east end of the Flanging Shop, and connected to a new Fielding & Platt accumulator (No.2076). At about this time much of the original hydraulic reticulation system was disconnected, and only the new Flanging Shop system left operable.

Flanging Shop machines still powered by the water-hydraulics system are the Fielding & Platt 1000 ton press (No. 2006), and Henry Berry vertical and horizontal presses (Nos. 251 & 1005). These are part of Group BO, Boilermaking.

Other hydraulic machines were converted to oil-hydraulic operation, each machine being connected to its own "tacked-on" oil pump and oil reservoir. These included a Fielding & Platt pipe bender (No. 400), the Buckton Chain Testing Machine (No. 456) in the Test Room, and the 1950s Henry Berry wheel press (No. 1699), buckling press (No. 1913) and stripping press (No.1975).

Group HY HYDRAULIC POWER SUPPLY (High Pressure Water)

SIGNIFICANCE

Items related to the High-pressure Water Hydraulic Power System (Group HY), are significant for reasons including the following:

* The present Flanging Shop hydraulic system (which includes the Worthington pump, the Fielding & Platt accumulator, a low-pressure return reservoir, and the several connected presses in the Flanging Shop), was in use up to late 1993. It is probably the last operating industrial water-hydraulic system in Australia, and is of very high significance in being able to demonstrate this power system which was of major importance to industrial development in Australia and elsewhere for over 100 years.

* The operable Worthington Pump (No.585) and Fielding & Platt accumulator (No.2076), are impressive pieces of machinery with considerable aesthetic appeal, and are ideal for working demonstrations.

* The partially dismantled Worthington Pump (No.586) in the Powerhouse might be able to be restored to working order, but even if not, it has significance as a display piece, and as a source of technical information about the inner details of water-hydraulic machinery.

* The remnants of the high pressure water reticulation pipe system are significant in yielding technical information about the pipes, for providing information about the extent of the distribution system, and sometimes about the location of machines connected to the system.

Group HY HYDRAULIC POWER SUPPLY (High Pressure Water)

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the Group HY Hydraulic Supply Equipment at the Flanging Shop, and the associated hydraulic presses (Group BO), as a working unit for museum display, and preferably for ongoing commercial use as well. This will involve running the system regularly, and oiling or greasing the sliding surfaces, to ensure they do not rust.

* Improve or rebuild the shed housing the Worthington Pump No.585, to provide better protection from weather and dust, and preferably to permit public viewing of the pump in operation. Keep the exposed pump pistons and bearings protected from grit when sitting idle, to prevent scoring and wear of the working parts on start-up.

* Gather spare parts removed from the Worthington Pump(s), and reassemble them to the Powerhouse pump No.586, to at least return it to complete appearance, and preferably to working order. If necessary, carefully measure and record the components, and make replicas to keep one or both pumps operational. Keep all unassembled components in a secure place. Do not discard original components, even if not reassembled.

* Return the partly destroyed Fielding & Platt Pump No.8150 to the Flanging Shop Pump House for reassembly to its foundation block, and for eventual public display and interpretation in comparison with the older and larger Worthington pump alongside. If possible, reproduce drawings and/or photographs of the F & P pump, to show what it was like originally and how it worked. At present, there appears no need to try to get the F & P pump back to working order.

* Get expert advice on conservation of the pumps, accumulators etc., (eg. to inhibit corrosion of the components in contact with water), especially as they may not get normal operation in future. Protect the exposed accumulator from deterioration, eg. from rusting at the junction between piston and cylinder gland, or at the base of the deadweight casing.

* Try to obtain more information about the original Powerhouse hydraulic pump and accumulators, and the hydraulic machines powered by that system, for use in an interpretative display of the existing hydraulic system.

Group HY **HYDRAULIC POWER**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
585	Worthington-Simpson 3-THROW HYDRAULIC PUMP	84	A	A	W	Y
586	Worthington-Simpson 3-THROW HYDRAULIC PUMP	22	A	A	D	Y
586	PARTS from Worthington-Simpson PUMP No.586	84	A	A	D	Y
2076	Fielding & Platt HYDRAULIC ACCUMULATOR	90	A	A	W	Y
8032	CAST-IRON WATER TANK (water hydraulic system)	84	B	A	W	Y
8150	Fielding & Platt 3-THROW HYDRAULIC PUMP	74	B	A	D	R
8185	HYDRAULIC HIGH-PRESSURE-WATER PIPELINE	45	A	A	D	Y
8185	HYDRAULIC HIGH-PRESSURE-WATER PIPELINE	46	A	A	D	Y

Group IN INSTRUMENT MAKING & REPAIR (Clocks, Watches and Gauges)

SUMMARY

The instrument repair facility was incorporated in the Electrical/Electronic Workshop. Here railway watches, clocks, pressure gauges etc., were repaired and adjusted. Very few items of equipment were found in this area in 1993, and those were of high but not very high significance. Nevertheless, conservation and display of those few items is recommended, as recognising this aspect of the Workshops' activities, and as a contrast to the heavy industrial nature of most other Shops.

SIGNIFICANCE

Items related to Instrument Making and Repair (Group IN), are significant for reasons including the following:

* They represent and remind us of the Workshops' involvement in the precise and delicate repair of small instruments, watches etc., an aspect of the Workshops' activities which is often overlooked.

* The "Timegrapher" watch and clock calibrator (No.8018) is also significant as an apparently fairly early electronic instrument, and almost the only electronic instrument surviving in the Workshops.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the several Group IN instruments for eventual display in the Workshops Museum.

* In the interim, keep the instruments in secure storage to prevent theft or disposal. Make sure all accessories are also kept, together with related manufacturer's manuals, operating instructions, test log books etc..

Group IN **INSTRUMENT MAKING & REPAIR**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2735	Barnet DEAD WEIGHT TESTING EQUIPMENT	30	B		W	R
8017	JEWELLER'S PUNCH with FITTED BOX	30	B		D	R
8018	"Timegrapher" WATCH & CLOCK CALIBRATOR	30	B		D	R

Group LS LINESHAFT SYSTEM

SUMMARY

Most of the historical railway workshops in Australia were built in the 1880s and 1890s, when stationary steam engines provided motive power to run machine tools etc. Typically each steam engine would drive one or several overhead "lineshafts" running the length of a workshop building, and each shaft would drive a number of separate machines (eg lathes, drills) via flat belts and pulleys. Changing the size of the pulleys allowed the various machines to be driven at different speeds from the same lineshaft.

Midland Workshops was built when large electric motors were starting to become economical and reliable, but before Perth had a substantial electricity generating station or reticulation system. Steam engines were still cheaper to install, but were more expensive to maintain and involved greater mechanical transmission and/or steam piping losses. After much deliberation, it was decided to use electric motors to drive machinery in the various Shops, supplied with electricity from Midland Workshops' own power station.

At that time, electric motors were still too bulky and expensive to provide one for each machine. Instead, several large motors were installed in each Shop, each motor driving a lineshaft which powered (say) 5, 10 or 20 machines. This was a transitional arrangement which lasted about 50 years, with individual electric motors on each machine not becoming common until after World War Two.

Plan 1379 (undated, but c1904), in the C.M.E. strong-room, gives a "TABLE OF LINESHAFTING: Disposal of Shafting, Couplings, Brackets." It lists a total of 3600 feet of 3 inch diameter line shafting (about 1 kilometre of 75mm shaft). It is not clear whether this table applied to the whole of the proposed Workshops, or just the half built in 1904.

The 1902 Select Committee Report noted that line shafting and Plummer Blocks (bearings) were to be supplied by Kendall & Gent, UK. However, PWD Plan 10666 - Shaft Bearings - shows lineshaft bearings etc, approved 1903 as per drawings by Messrs Selig Sonnenthal & Co., Engineers, London. Other contemporary plans of lineshafting are:

Plan 871, (1902) Arrangement of Lineshafting;

Plan 10543 (1903) Shafting, Brackets & Hangers (with self-aligning bearings).

The Boiler Shop, Blacksmiths Shop and Wood Mill all had machinery driven by lineshafts. However, the most extensive array of lineshafting was in the Machine Shop, which from 1904 to c1952 had dozens of lathes, drills, etc. connected to overhead pulleys by a web of flat leather belts. The Machine Shop had lineshafts running along the north wall of Bay 1, along the main steel columns between Bays 1/2 and Bays 2/3, and along two extra sets of subsidiary steel columns running down the middle of Bay 1 & Bay 2.

Group LS **LINESHAFT SYSTEM**

SUMMARY (Continued)

In c1952, as part of a major post-war refurbishement of the Workshops, the old belt-driven lathes were removed and replaced by new machines (mostly the present-day Dean Smith & Grace lathes) with their own in-built electric motors. Other old machine tools were replaced or had electric motors bolted on, and almost all of the lineshafting was removed.

Today, there is just one short length of lineshafting left at Midland (No.8243), driving the old Horsfal (Greenwood & Battley) Nut & Bolt Forging Machine (No.224). However, there is a range of evidence of the former lineshaft system, in the form of bolt holes for removed bearing brackets, oil stains from bearings, recesses for bearings, a pair of brackets for an electric motor, and one lonely half-plummer block (No.8029) which carried the end bearing for one of the Machine Shop lineshafts.

Group LS LINESHAFT SYSTEM

SIGNIFICANCE

Items related to Lineshafting (Group LS), are significant for reasons including the following:

* They represent the power transmission system which drove most of the Midland machine tools for the first 50 years of the Workshops' life.

* They provide evidence of the extent and design of the lineshaft system, and of the layout of machines driven by the lineshafts, to supplement the evidence found in drawings.

* The surviving short section of lineshafting (No.8243) driving the Horsfal Nut & Bolt Machine (No.224), has excellent potential to provide a working demonstration of the historically important lineshaft, flat belt and pulley system which powered most Midland machine tools from 1904 up until the 1950s. It is also a now rare working example of the type of transmission system (connected to either steam or electric motors) which powered most factory and industrial workshop machinery in Australia during the 19th and first half of the 20th century.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve in situ the remnant lineshafting (No.8243), and associated electric motor and Nut & Bolt Machine (No.224), for working display.

* Conserve the Mastabar belt joiner (No.8096), and any spare flat belts or belt clips etc., in a secure place for an eventual static display of belt joining methods, and possibly for repair of the belts used in the working display.

* Note the location of all evidence of lineshafting, in comparison with existing archival drawings of lineshaft layout, and particularly note any discrepencies between the documentary and physical evidence.

* Leave the evidence of lineshafting in situ, other than removing grease stains if they are incompatible with the future use of the Workshops buildings.

Group LS **LINESHAFT SYSTEM**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8029	LINESHAFT REMNANTS (Bolt Holes & Bracket)	47	B	B	D	Y
8029	LINESHAFT REMNANTS (Bolt Holes in channel)	47	B	B	D	Y
8029	LINESHAFT REMNANTS (Brackets)	45	A	A	W	Y
8029	LINESHAFT REMNANTS (Brick piers & arch)	45	A	A	D	Y
8029	LINESHAFT REMNANTS (Plummer Block)	45	A	A	D	Y
8096	Mastabar DOUBLE LEVER SPEED LACER	47	B	A	W	O
8243	LINESHAFT REMNANTS (Pulleys & Flat Belts)	46	A	A	W	Y

Group MH MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)

SUMMARY

A railway workshops has to handle large quantities of materials, including heavy individual pieces (eg locomotive boilers, bogies, and complete locomotives, carriages or wagons). Consequently, the Workshops had a lot of mechanical handling devices, including large overhead cranes, small wall-mounted jib cranes, steam cranes, jacks, trolleys, etc.. Some of these devices served specific machines, and are discussed and assessed in conjunction with the trade groups for those client machines. Others were of a more general purpose nature, and are discussed and assessed here as Group MH.

The most obvious and dominant materials handling devices at Midland are the overhead travelling cranes found in most major Shops. In the 19th Century, steam-powered workshops had to resort to complex recirculating rope drives to deliver power from stationary ground-based steam engines to overhead travelling cranes. Electric drive to overhead cranes was much easier, and in the late 1890s and early 1900s this was one of the first industrial applications of the newly developed electric motors. Midland Workshops had about 30 electric-drive overhead travelling cranes, right from establishment, and these had a major influence on the design of the buildings in which they were located.

The cranes required long parallel-sided column-free bays in which to travel, but with crane-rail beams each side supported on columns or wall piers. For simplicity, the cranes were designed to one or other of two standard spans, and the bays in which they operated had to follow the same standards. Any lineshafting, belts or machine tools in the area had to be well clear below the level of the travelling cranes, and any roof structures had to be located clear above the cranes. The buildings had to be tall enough to accommodate the travelling cranes, and to allow suspended loads to be lifted high enough to travel above other objects on the floor. The crane beams, and their supporting columns and brick walls, had to be strong enough to carry the weight of the cranes and their largest load, and to resist the horizontal forces involved in accelerating or braking the travelling cranes.

New Hoskins electric overhead travelling cranes were installed in the 1950s, replacing many of the Oerlikons. In the 1960s, several Eilbeck cranes were installed, and most of the remaining Oerlikons refurbished. In c1983, more Eilbecks were installed and all except three Oerlikons removed. (See Plant Engineer's crane records, and Plans PL-298, PL-813.)

All of the overhead cranes (including the Oerlikons, Hoskins and Eilbecks) originally had to be operated by a full-time crane driver sitting in a cabin mounted on the travelling crane. Recently the cranes still in use were converted to pendant control, allowing people other than permanent crane drivers to operate the cranes from floor level, thus greatly reducing their cost of operation.

Group MH MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)

SUMMARY (Continued)

Only three of the original electric cranes made by the German company Oerlikon have survived (Plant Nos. 8020, 8071 & 8102), one in the Gap Riveter Tower, one (inoperable) in the Power House, and one in the Main Store. These cranes should all be conserved as early examples of electric cranes, of the type crucial to the operation of the Workshops for about 50 years.

The Hoskins cranes have sufficient heritage significance to warrant keeping one or two samples for heritage reasons, and to make visible the underlying purpose of the tall, long, open bays designed into the buildings. However, it is recommended that all of the overhead cranes be retained in situ, including the new Eilbecks, because they would improve the options and viability for future use of these historic industrial buildings.

There are several large specialised lifting aids in the Car & Wagon and Erecting (Fitting) Shops, eg. for picking up whole carriages with an overhead crane. These are quite modern, and do not warrant conservation or listing as heritage items. However, they would probably have ongoing use for ARHS, or for a commercial workshop making or repairing rolling stock. If not, then they should be left on site in the interim, for possible use in handling displays of rolling stock. There are also numerous small screw-jacks or fixed-height stands, used to support carriages etc when their bogies are removed. These jacks and stands (Item No.8215) should be conserved for display and for possible use.

Small jib cranes (swing arms hung off walls or columns, and fitted with A block-and-tackle or light hoist), were widely used to assist loading heavy jobs into lathes etc. Many still exist (eg. Nos. 8179, 8181, 8187, 8196), although most now have modern chain blocks or electric hoists attached. A few of the more original small jib cranes should be conserved for display and use, in conjunction with machine tools. Several much larger jib cranes serve the steam hammers in the Blacksmiths Shop (see Plant Nos. 652, 653, 3403). These large jib cranes should all be conserved with their client hammers.

Hydraulic cranes are mentioned in several reports and site plans of c1904. Such cranes (operated by water powered hydraulic rams) were common then. No hydraulic cranes were seen at Midland in 1993 (although some still survive elsewhere, eg. at Newport in Victoria).

Group MH MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)

SUMMARY (Continued)

Mobile Ransome Rapier or Thomas Smith steam-powered cranes, running on the yard rail lines and carrying their own small boilers, were widely used at Midland up until about the 1950s. They lifted loads in the open, and were also used to drag loads from inside the workshop buildings, using cables run in through the side doorways - but this scarred the walls (No.8254) and is said to have once tipped over a crane. In 1993 there was one Thomas Smith crane and separate jib (No.8150) in the Salvage Yard, and another (No.8168, apparently donated to ARHS) was in the ARHS sidings. Both should be conserved, and re-assembled for at least static display.

Manually pulled trolleys were extensively used as a cheap and simple way of moving heavy loads within buildings, and between buildings. Some trolleys had flanged wheels (No.8012) running on a network of rails in the floor, with rails running east-west within each bay of the main buildings, and other sets of rails running north-south to allow transfer from bay to bay or from building to building. At the intersections there were small turntables set in the floor (No.8012), to switch trolleys between north-south and east-west tracks. This rail network was fundamental to the layout of the main workshops buildings, and remained partly in use up to the 1990s.

There were many non-tracked trolleys running on plain floors, originally with smooth cast-iron wheels (No.8058, for Plant Maintenance) but later with rubber-tyred (No.8037 or 8178)) or plastic-tyred wheels. Some were simple flat-topped trolleys, others had toolboxes or even small workbenches built-on. An interesting small Transporting or Platform Truck (No.8165) is a hand-operated precursor of modern hydraulic pallet trucks. Representative samples of these various trolleys, and the rail & turntable network, should be conserved and displayed (and used).

Other types of materials handling equipment still in use in 1993, included Workshops-made boilerplate crane skips (eg. No.8019), beautifully made hand pallets or stretchers (No.8145) in the Wood Mill, a steel scrap bin fitted on a 2-wheel trolley (No.8208), Workshops-made rubbish bins (No.8074), and traditional cane baskets originally used for wood scraps or small workpieces (No.8203).

The weighing of vehicles or materials is a common requirement in workshops, factories etc., and is normally considered a part of materials handling. An old "Pooley" we0ighbridge (No.8210) of the type used for weighing motor lorries or horse-drawn drays, is in the Salvage Yard, dismantled. Even if not working, it is an interesting static display item, with "WAGR" cast into the platform.

Group MH **MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)**

SUMMARY (Continued)

A specialised Fairbanks Loco Weighbridge (No.545) for checking the weight distribution on loco axles, is under the floor of Shed 28. A c1904 Pooley car & wagon weighbridge is listed in plant records, but was not found. These were both specialised equipment for maintenance of rolling stock, and are discussed under Group RS.

Numerous small ornate Avery platform scales were found in the Shops. Although still fairly common, at least a few Avery scales should be conserved as significant artefacts, and for ambience in a museum display context.

A very specialised materials handling system was built into the Boilerhouse, with an unusual style of conveyor-cum-elevator with iron buckets on an endless chain loop, used for bringing coal into the Boilerhouse bunkers, and for removing ash from an ash collection tunnel beneath the Boilerhouse floor. This system had associated coal bunkers, ash bins and hoppers, inside and outside the Boilerhouse, as clearly shown in original drawings of the building. These bins, bunkers and the conveyor were removed on conversion of the Boilerhouse to a Coppersmith's Shop, but evidence remains, including the steel frame of the coal bunkers and an opening through which the coal and ash conveyor passed (No.8155).

Coal was a constant preoccupation until the 1960s, even after the steam boilers were phased out, because coal was needed for the steam locos. The unstable Collie coal was stored under water in the Coal Dam (formerly a reservoir), with a large travelling gantry crane to dump the coal under water and grab it out again. The crane (No.8204) was moved off site to the Flash-Butt Welding Yard some years ago, but its travelling rail supports and the remains of a siding still project from the dam (see No.8258, in the Site Features Inventory, Group SI).

Group MH MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)

SIGNIFICANCE

Items related to Materials Handling (Group MH), are significant for reasons including the following:

* Materials Handling equipment as an overall group is of very high significance, as a facility which affected virtually every aspect of the Workshops' operations, and which strongly influenced the layout and design of the Workshops' main buildings.

* The overhead travelling cranes were an important part of the Workshops plant, essential for the operation of most of the Shops, and influential in the design of most of the buildings. The Oerlikon cranes are the last of more than 30 such cranes originally installed, and were quite early examples of electric cranes when installed c1902-04. The later Hoskins and Eilbeck cranes are less significant, but demonstrate later evolution of electric overhead cranes, and may be essential for future use of other conserved machinery served by those cranes.

* The small jib cranes were an important aid to the safe operation of the various machines they served. The large jib cranes serving steam hammers are significant artefacts in themselves, but were primarily significant as part of the steam hammer infrastructure.

* The travelling steam cranes are significant as artefacts in their own right, and as demonstrating continuing use of steam power for about 50 years, even in a nominally electric-powered workshops.

* The Avery (or equivalent) platform and bench scales are representative examples of a type of device widely used at the Workshops for the last 90 years, and their style would add ambience to the proposed Workshops Museum.

* The trolley rail network and associated trolleys and turntables have very high significance, as a major method of moving materials around the Shops, which was an important factor in the layout of the original Workshops buildings in 1902-04, and which remained at least partially in use to 1993.

* The numerous minor items of materials handling equipment, including wooden stretcher-type pallets in the Wood Mill, the various mobile toolboxes and workbenches, the baskets and scrap bins, are significant as representing daily working aids used in the Workshops, and as potential interpretative devices for the Workshops Museum.

Group MH **MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)**

SIGNIFICANCE (Continued)

* The Boilerhouse Coal & Ash handling remnants are significant as reminders of the original on-site electric power generation system, which ultimately relied on the power of steam produced from burning coal. It is also of significance as physical evidence to confirm the documentary evidence found in drawings of the Power House and Boilerhouse, and possibly as an aid in interpreting that evidence to the public.

* The Coal Dam Crane (now Flash-Butt Crane) and the surviving crane rail support structure at the Coal Dam are of interest as the surviving visible evidence of the extent of ongoing use of coal after World War Two, and the special difficulties of using the local Collie Coal.

Group MH MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)

RECOMMENDATIONS & CONSERVATION POLICY

* Only three of the original electric cranes made by the German company Oerlikon have survived (Plant Nos. 8020, 8071 & 8102), one in the Gap Riveter Tower, one (inoperable) in the Powerhouse, and one in the Main Store. These cranes should all be conserved as early examples of electric cranes, of the type crucial to the operation of the Workshops for about 50 years.

* The Hoskins cranes have sufficient heritage significance to warrant keeping one or two samples for heritage reasons, and to make visible the underlying purpose of the tall, long, open bays designed into the buildings. However, it is recommended that all of the overhead cranes be retained in situ, including the new Eilbecks, because they would improve the options and viability for future use of these historic industrial buildings, and of the historic workshops equipment retained in the buildings.

* Keep those small jib cranes which already serve the machines recommended for conservation. If necessary, conserve other small jib cranes as well, to get a fully representative sample of the various types used. Relocation of these small jib cranes within the Workshops is optional, provided their new locations and new mounting methods are typical of real working installations. The large jib cranes serving steam hammers should be conserved in working order, and in situ with their hammers.

* Conserve the two surviving steam cranes (Nos.8150 & 8168), one of which is apparently now owned by ARHS, and the other by WAGR. Reassemble the WAGR crane to at least appear to be in working order. Preferably restore one of the two cranes back to working order, for public demonstration. Keep the loose boiler (No.8147) as a spare, if it comes from a similar steam crane.

* The Avery (or equivalent) platform and bench scales should be kept as ancillary equipment for incorporation into working museum displays of the various Shops.

* The trolley rail network and associated trolleys and turntables should be conserved in toto if possible, or at least in the majority of the Shops in which it now exists. The retained system should be sufficient to show the extent of the network, and to show how each main building was linked to the others.

Group MH **MECHANICAL HANDLING (Cranes, Trolleys, Scales etc.)**

RECOMMENDATIONS & CONSERVATION POLICY (Continued)

* The Boilerhouse Coal & Ash handling remnants (ie. the steel framing for the bunkers, and the conveyor opening in the north wall) should be conserved and incorporated into the interpretation of the original function of the Boilerhouse. The physical evidence and documentary evidence should be compared, and any discrepencies noted. If possible, the underfloor structure of the Boilerhouse should be investigated, to see whether any of the major sub-floor ash handling system shown in PWD drawings still survives.

* The surviving crane rail support structure at the Coal Dam should be left in situ and used to interpret the extent of ongoing use of coal after World War Two, and the methods used to store and handle the local Collie Coal. (However, if the area is open to the public, the dam and crane support structure may need fencing or similar to ensure children do not climb on the structure and fall into the dam.)

* The "Victoria" crane (No.8123) associated with the Buckton Chain Tester (No.456), should be conserved in situ, or relocated with the Chain Tester if the test equipment is moved to another building.

* The components of the dismantled Pooley Weighbridge (No.8210) should be relocated to a secure part of the Workshops, and kept for further investigation and probably for use in a static interpretative display.

* The various screw jacks and fixed stands (Nos.8215) used in maintenance of carriages etc., should be relocated to a secure storage area and kept for use in interpetative displays of rolling stock maintenance.

* The numerous minor items of materials handling equipment identified in the Inventory, including wooden stretcher-type pallets in the Wood Mill, the various mobile toolboxes and workbenches, the baskets and scrap bins, should be conserved for use as interpretative devices for the Workshops Museum.

Group MH **MECHANICAL HANDLING (Cranes, Trolleys, Scales, etc.)**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8012	HAND TROLLEY (on Narrow-gauge Trolley Line)	47	A	A	W	O
8012	TROLLEY- LINE TURNTABLE	47	A	A	W	Y
8019	CRANE SKIP	33	A	A	W	O
8020	Oerlikon 3-ton OVERHEAD TRAVELLING CRANE	43	A	A	W	Y
8020	HOOK detail from 3-ton Oerlikon CRANE	43	A	A	W	Y
8037	HAND TROLLEY with Rubber Tyred Wheels	17	B	B	W	O
8063	Avery PLATFORM SCALES	23	B	B	W	O
8071	Oerlikon 5-ton OVERHEAD TRAVELLING CRANE	22	B	A	D	Y
8071	Oerlikon 5-ton OVERHEAD TRAVELLING CRANE	22	B	A	D	Y
8089	MATERIALS STAND with RATCHET ADJUSTMENT	46	B	B	W	O
8112	Thomas Smith of Rodley 3.5-ton STEAM CRANE	74	A	A	D	R
8112	Thomas Smith of Rodley 3.5-ton STEAM CRANE	74	A	A	D	R
8112	Thomas Smith of Rodley STEAM CRANE JIB	74	A	A	D	R
8114	Vickers-Hoskins 10-ton O'HEAD TRAV. CRANE	52	B	B	C	Y
8116	Vickers-Hoskins 5-ton O'HEAD TRAVELLING CRANE	52	B	B	C	Y
8123	"Victoria" OVERHEAD TRAVELLING CRANE	54	A	A	W	P
8145	HAND PALLETS or STRETCHERS	47	A	A	S	P
8147	OLD BOILER (possibly from a Steam Crane)	32	?	?	H	O
8165	TRANSPORTING TRUCK (or PLATFORM TRUCK)	66	A	A	W	R
8168	Thomas Smith of Rodley 3-ton STEAM CRANE	95	A	A	D	R
8168	Thomas Smith 3-ton STEAM CRANE (nameplate)	95	A	A	D	R
8179	Small JIB CRANE (SWL 50kg)	59	B	B	S	O
8181	TWIN JIB CRANES (on a shared mast)	59	B	B	S	O
8187	Small JIB CRANE (pivoted on a steel column)	45	B	B	S	O
8191	DUAL-GAUGE TURNTABLE & RAIL LINES	45	B	B	D	Y

Group MH **MECHANICAL HANDLING (Cranes, Trolleys, Scales, etc.)**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8196	300kg & 200kg JIB CRANES	59	B	B	S	O
8204	Vickers Hoskins OVERHEAD TRAVELLING GANTRY	98	B	B	C	Y
8208	STEEL SCRAP BIN	45	B	B	D	O
8210	Pooley WEIGHBRIDGE	90	B	B	D	R
8210	Pooley WEIGHBRIDGE	90	B	B	D	R
8214	RIVETED STEEL-RACK	45	A	A	W	O
8215	Fixed Height CAST-IRON STANDS	90	A	A	W	R
8215	Group of SCREW JACKS for Carriages or Wagons	45	A	A	W	R
8215	Two-way ADJUSTABLE SCREW JACK	45	A	A	W	R
8227	Avery PLATFORM SCALES	14	B	B	W	O
8228	Avery BENCH-TOP SCALES	14	B	B	W	O

Group MI MISCELLANEOUS

SUMMARY

Group MI covers a mixed bag of items not fitting into other main Groups. At least several have high to very high heritage significance and should be conserved for static or working display in conjunction with the Workshops Museum, as noted in the individual inventory sheets.

SIGNIFICANCE

Miscellaneous items (Group MI) which could not be identified with any particular group, still have a level of significance that is worth recording:

* The fibreglass machines Nos.2718, 2800 & 3120 were of moderate significance only, as early but rather crude examples of their type.

* Hardy's Chain and Wire-rope Cutter (No.8024) is significant as an example of a rare specialised manual-powered tool which is light and portable but capable of cutting quite heavy cables or chains in the field.

* Templates No.8034 are relatively modern, but represent a method of marking and making carriage, wagon or loco panels which has been used extensively at the Workshops over many years.

* Disused motors, controls, springs etc., stored on the Powerhouse Mezzanine Floor, (No.8083) need further assessment, but appear to include items of high significance.

* A Model of Midland Workshops (No.8100) is of significance as a record of the Workshops since c1970, and as an interpretative and planning aid.

* A Hewlett Packard electronic programmable printing calculator Model 46 (No.8122) represents the state-of-the-art in its day, and is or will become a museum item of heritage significance.

* A diagramatic working model of steam locomotive valve gear (No.8133) was probably made at the Workshops, and is one of very few examples seen of the important role of the Workshops as a centre for technical training.

Group MI **MISCELLANEOUS**

SIGNIFICANCE (Continued)

* A traffic staff device (No.8152), and a set of points levers (No.8154), are not directly related to the Workshops, but are good examples of their type and would be useful as interpretative aids in a display of safe working systems.

* A toy train made in the Workshops (No.8249) gives a poignant human touch to the inventory of heritage artefacts, is a nice example of the Tinsmiths' craft, and would be an attractive addition to a Workshops Museum display.

Group MI **MISCELLANEOUS**

RECOMMENDATIONS & CONSERVATION POLICY

* The fibreglass machines Nos.2718, 2800 & 3120 were noted for the Inventory, but were not considered of sufficient heritage significance to be conserved.

* The Hardy's Chain and Wire-rope Cutter (No.8024) should be stored in a secure place, and oiled to prevent further corrosion. Its function within the Workshops should be identified if possible, and it should then be incorporated into the appropriate part of the Workshops Museum as an interesting artefact in its own right.

* Sample Templates (eg. No.8034) should be kept for display in the Workshops Museum, to demonstrate this method of marking and making carriage, wagon or loco panels. The sample templates for display will presumably be obsolete, and should be clearly identified as such to prevent mistaken use for current jobs.

* Disused motors, controls, springs etc., stored on the Powerhouse Mezzanine Floor, (No.8083) need further identification and assessment.

* A Model of Midland Workshops (No.8100) should be conserved for display in the Workshops Museum, and possibly as an aid to future planning of the site. The date it represents should be identified.

* Hewlett Packard electronic programmable printing calculator Model 46 (No.8122) should be conserved for display in conjunction with the Test House or Administrative equipment. The calculator should be kept complete with its case, manuals, power cord, paper rolls, and if possible examples of calculations for which it was used.

* The diagramatic working model of steam locomotive valve gear (No.8133) should be conserved for display in the Workshops Museum, as a training aid. If possible, its provenance should be determined.

* The staff device (No.8152), the set of points levers (No.8154), and similar devices in or near the Salvage area, should be stored in a secure place for possible use in museum display of safe working systems, possibly in conjunction with ARHS.

* The toy train made in the Workshops (No.8249) should be kept in secure storage, and used in a display item of the Tinsmiths' craft, or in a museum display related to Workshops People.

Group MI **MISCELLANEOUS**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2718	FIBRE-GLASS CHOPPER GUN	74	C	C		
2800	Robinson FIBRE-GLASS RESIN/CUTTER	74	C	C		
3120	Mark-1 FIBRE-GLASS GEL-COATER	74	C	C		
8024	Hardy's CHAIN & WIRE-ROPE CUTTER	90	A	A	W	R
8034	TEMPLATES	52	B	B	S	R
8083	MISCELLANEOUS DISUSED MACHINERY	22			H	R
8092	3-LEGGED CAST-IRON STAND	47			H	O
8100	MIDLAND WORKSHOPS TABLE MODEL	47	A	A	D	R
8122	Hewlett Packard CALCULATOR Model 46	54	B	B	D	O
8133	STEAM LOCO DIAGRAMMATIC MODEL	9	B		D	R
8152	Railway Signal Co. STAFF SAFE-WORKING DEVICE	74	A	A	S	R
8154	McKenzie & Holland SETS of POINTS LEVERS	74	A	A	D	R
8249	"TIN" TOY TRAIN	24	B		D	R

Groups MS MT MW MACHINE SHOP - TOOL ROOM - WHEEL SHOP

The Machine Shop Group has been divided into three sub-groups, identified as:

Group MS - MACHINE SHOP - GENERAL

Group MT - TOOLMAKING

Group MW - WHEEL SHOP SECTION

Group MS MACHINE SHOP - General

SUMMARY

Group MS covers a wide variety of general-purpose machine tools (eg lathes, drills, milling machines), for cutting or grinding metal objects to precise shape and size. The Inventory for this group includes a large number of such machine tools, with dates of origin ranging from c1904 up to c1990. Most of these machine tools were found in the Machine Shop (Block 3), but some were found in other Shops (eg. the Track Equipment Shop). These machines constitute a very highly significant group, representing the evolution of machine tools from c1904 to the present day.

The metal-working machine tools initially installed at Midland, and those additional machine tools installed up to World War Two, were almost exclusively British-made, and were mostly flat-belt driven from overhead lineshafting (see Group LS). Most Machine Shop tools from c1904 have gone, but a few have survived, as have a considerable number of fairly similar machines from the 1920s. These machines are of a size and style once common in major workshops, but rarely seen today.

Like many other enginering establishments, Midland Workshops was heavily involved in the manufacture of munitions, armaments, marine engines etc., during World War Two. The Machine Shop and Toolroom still has a number of machine tools installed to handle wartime defence production, some still carrying "Ministry of Munitions" labels, and these are recommended for conservation as a tangible reminder of the Workshops' role in World War Two.

Many of these machines are shown on the Plant Cards as acquired 1946, but presumably that is when ownership passed from Ministry of Munitions to Westrail. (There is some question about what obligations Westrail has in relation to Ministry of Munitions machines. Comments in post-war C.M.E. Reports suggest that Westrail is under an obligation to maintain the machines in working order, in perpetuity, and to ensure they are available for use by the Commonwealth if ever required again for national defence.)

Group MS **MACHINE SHOP - General**

SUMMARY (Continued)

In the early 1950s the Workshops underwent another major re-equipment programme, based on post-war reconstruction funds from the Commonwealth. This particularly affected the Machine Shop, and consequently most of Midland's machine tools date from that era. These were still mostly British-made, but included some from USA, and some Australian-made. These new machines were fitted with integral electric motors, as was becoming common by then. This allowed removal of the original overhead lineshafting, after the few remaining flat-belt drive machines were fitted with bolted-on modern electric motors. The 1940s and 1950s machines have remained in use to the present day, ie. for 40-50 years, although modern computer-controlled machine tools have recently started taking over.

Midland Workshops' Machine Shop has an unusually comprehensive and impressive collection of machine tools covering both general-purpose and special-purpose machines, from present-day back to the 1910s and 1920s. Midland has certainly the most significant collection of hisdtoric machine shop tools in W.A., and (with the stripping of Eveleigh, Newport and Cockatoo Island Workshops) probably the best and most significant collection still extant in Australia.

These machines could be used for ongoing railway maintenance or restoration work, or for general contract jobbing work. However, the associated cutting tools, clamps, job steadies etc, need to be conserved with the machines, as do any instruction manuals. Preferably, the former machine operators will remain available to operate the machines or to train new operators.

Several machine tools of a specialised nature are discussed under Group RS - Rolling Stock or Group TR - Track Equipment. These include two large Churchill grinders (Nos. 1980 & 2221), both in Block 3, and two planing machines in the Track Shop (Nos. 1013 & 2036).

Group MT MACHINE SHOP - TOOLMAKING

SUMMARY

Within the Machine Shop is a Toolroom which manufactured cutting tools, forging dies etc. to be used in other machines in other parts of the Workshops, and which resharpened used cutting tools. The Toolroom also made precision gauges for checking the size and shape of components made elsewhere. The Toolroom was equipped with specialised machine tools and measuring equipment, which tended to be more precise than those used elsewhere. Similarly, the toolmakers tended to be the more highly skilled elite tradesmen of the Machine Shop.

There were toolmakers at Midland from the outset, but the Toolroom was greatly expanded during WW2, and reputedly became the main toolmaking centre in W.A. Most of the present toolmaking machines (eg tool-and-cutter grinders, thread grinders, etc.) date from World War Two, although some were obtained later, notably a semi-automatic hydraulically controlled copying mill (No.1624) for making complicated dies, before the days of computerised machines. It is recommended that a group of toolmaking machines be conserved, to represent this important but often overlooked facility.

Inspection equipment located in the Toolroom (and elsewhere) is considered in Group QC, Quality Control.

Group MW **MACHINE SHOP - WHEEL SHOP SECTION**

SUMMARY

One of the most important and consistently busy parts of any railway workshop is the Wheel Shop, where worn locomotive, carriage and wagon wheels are reconditioned ready for further service. Without a wheel reconditioning service the railways would soon grind to a halt. Midland formerly had a very extensive Wheel Shop with a large number of specialised wheel lathes, for turning (machining) two flanged wheels simultaneously, while they are mounted on their axle, thus ensuring that the two wheels are the same size and perfectly concentric with the axle bearings. These lathes were of various sizes, for handling small wagon wheels or the largest steam loco driving wheels.

The original Wheel Shop had water-powered hydraulic presses for pushing the wheels on or off the tight-fitting axles, burnishing lathes for producing a very smooth surface on the axle journals (to improve the life of plain metal axle bearings, before the days of roller bearings), and machines for turning steel "tyres", and for heating (expanding) tyres then shrinking them onto wheels. Carriage and wagon wheels used to have a cast-iron centre and a heat-shrunk steel rim or "tyre", which could be turned to correct profile several times, or could be removed and replaced with a new tyre when it was too worn to be reconditioned again. Modern cars and wagons have solid steel wheels without separate tyres.

The Wheel Shop underwent major modernisation in the early 1950s, with a new wheel press and several new wheel lathes being installed (and apparently the older wheel lathes and wheel press removed). As at 1972 (Plan PL-164) the Wheel Shop still had five wheel lathes, an axle burnisher and a tyre heater. In the late 1980s and early 1990s a further major modernisation of the Wheel Shop was planned. The tyre heater and many of the 1950s wheel lathes were removed to make way for new wheel lathes - which did not eventuate. The current Wheel Shop is therefore a scant remnant of its former self, having only one modern Hitachi Seiki wheel lathe instead of the three or four "Loudon" Scottish wheel lathes previously in place there. Nevertheless, the Wheel Shop still has three long axle lathes, two wheel presses (one, the Henry Berry, originally water-hydraulic powered), and a (disused) axle burnishing lathe.

An axle journal grinding machine (No.2061) still exists, but has been removed to the New Tarpaulin Shop, and is inoperative. A very specialised crankpin grinding and quartering machine (No.1105, for precisely grinding the crankpins set 90 degrees apart on the side of steam locomotive driving wheels) also exists, but has been given to ARHS, and is currently sitting on a flat-bed wagon in the ARHS sidings.

Group MW **MACHINE SHOP - WHEEL SHOP SECTION**

SUMMARY (Continued)

Although the Henry Berry Wheel Press (Item 1699) and the Churchill Loco-Axle-Journal Grinder are the only machines still in the Wheel Shop to be assessed as having very high individual significance, the other Wheel Shop machines are assessed as being of very high significance when considered as an integrated operational group. Consequently, the Wheel Shop group is recommended for conservation as a now-rare working example of this most important aspect of the Midland Workshops activities.

Given the specialised nature of the Wheel Shop, and given the government's decision to close Midland Workshops before an alternative private wheel-repair facility was established outside, it seems likely that some of the Midland Wheel Shop plant will still need to be used for on-going wheel maintenance, at least in the short term. If so, this should be done by lease of the equipment on-site, rather than letting items be sold or leased off-site, and dispersed. The lease agreement should include strict controls to ensure the equipment is not altered or damaged in a way that diminishes its heritage significance.

The future management of the Wheel Shop operation could well consider the acquisition of a second-hand tyre heater and a second-hand large wheel lathe for turning the wheels of historic steam locomotives - local, national or international. Such lathes do still exist. There is a large lathe (about 7 feet diameter face plate) lying in the yard at Newport, and there could still be a disused one at Ipswich. In the UK in 1992 there were no large wheel lathes still in existence. British Rail must send the wheels of their big steam locos like the Flying Scotsman or the Duke of Gloucester to India for repair.

Groups MS MT MW MACHINE SHOP - TOOL ROOM - WHEEL SHOP

SIGNIFICANCE

Items related to the General Machine Shop, the Tool Room or the Wheel Shop (Groups MS MT MW), are significant for reasons including the following:

* The Machine Shop equipment as a whole, represents a very comprehensive range of large industrial metal-cutting machine tools from the mid 20th century, and a less comprehensive but still notable collection of machine tools from the 1920s. Midland has probably the most extensive collection of operable machine shop tools of that 1920s to 1950s period to still exist in Australia.

* The 1920s machine tools (mostly large planing machines and drills) represent a major expansion in the capacity of the Workshops, and particularly reflect the ability to make rather than just repair locomotives.

* Most of the Machine Shop tools (too many to list in this summary), were chosen as being the best tools of their type in their day, and so have high to very high significance individually, and collectively represent the state-of-the-art in machine tools over the early to mid 20th century. (As a result, most tools are still in good working order and capable of producing high quality work, despite their age.) Some of the machine tools, such as the crankshaft grinder No.2267, are also significant (and commercially important) as being the only and/or the largest of their type still operating in Western Australia, or even in Australia.

* Although most machine tools were imported from Britain, or more recently from USA and Japan, some were made in Australia (eg. Nos.1177, 1301(?), 1337, 1338). These were probably made locally to overcome wartime or immediate post-war shortages, but were still in use up to 1993, and are significant in representing the ability of Australian engineering industry to make good quality machine tools when given the opportunity.

* The Toolroom is significant as the most precise part of the Machine Shop, and the area where the most elite of skilled tradesmen tended to be found. It was the area which made the cutting and forming tools, and quality control gauges, used by other parts of the Machine Shop, and so had to work to a higher order of precision than the rest of the Machine Shop. The Toolroom machine tools date from 1940s and 1950s, and represent the dramatic increase in precision machining capacity introduced to the Workshops to meet wartime needs, and which continued after the War as one of W.A.'s main centres of toolmaking (and tool measuring) capacity. Many of the machines still bear "Ministry of Munitions" plates which signify this period in the Workshops' history.

Groups MS MT MW **MACHINE SHOP - TOOL ROOM - WHEEL SHOP**

SIGNIFICANCE (Continued)

* Although most of the more historic machines have been removed from the Midland Wheel Shop, it is still significant as an overall operating group representing a very specialised part of the Workshops which has provided a service crucial to the continued running of the railways ever since the Workshops was established, and which has remained consistently busy up to the 1994 closure of the Workshops. Several surviving Wheel Shop machines are individually significant, including the Berry Wheel Press (Item No.1699, originally designed for water hydraulics), two axle journal grinders (Nos.2041 and 2061), and a steam loco crankpin grinding and quartering machine (No.1105, now with ARHS).

Groups MS MT MW MACHINE SHOP - TOOL ROOM - WHEEL SHOP

RECOMMENDATIONS & CONSERVATION POLICY

* A large number of machine tools in the Machine Shop should be conserved as a group, to conserve their significance as an outstanding collection of mid and early 20th century machine tools, and as the core of a working museum of the engineering industry. Preferably, some additional old machine tools should be aquired from elsewhere to supplement the display, by representing the early belt-driven lathes and milling machines that were removed from Midland in the 1950s.

* The Machine Shop collection (including the Toolroom) should preferably be displayed as part of a working museum, but able to undertake contract work for the railways, for ARHS, or for general industry. This would provide the museum with a supplementary source of income, would demonstrate real work, and in some cases would provide a service to industry (eg grinding of large diesel engine crankshafts) which otherwise may not be available in W.A., or elsewhere in Australia.

* If the museum is not established immediately, the Machine Shop equipment could be leased in situ as a going concern suitable for use by a large engineering company. The lease would be subject to protection of the historic equipment, but would not preclude removal of redundant non-historic equipment and introduction of new equipment into the spacious Machine Shop building. The historic equipment would be expected to be used for museum purposes eventually. To make this option viable, the more modern machine tools not identified as heritage items may also need to be kept, at least for the duration of the commercial lease.

* Whether kept for museum or commercial purposes, the conserved equipment will need to have all cutting tool bits, tool holders, adjusting spanners, workpiece clamps, and similar accessories, conserved with the parent machine. Any operating or maintenance manuals should also be conserved. For display purposes, typical samples of materials used and jobs produced by the machines should also be conserved. To keep the Machine Shop operable, the cranes which service the machines should also be retained.

* The machine tools are spread over a large area of Block 3, which already has gaps from removed machines, and could have more gaps when additional non-heritage machines are removed. While it is preferable to keep the Machine Shop tools in situ, the collection of machine tools could be relocated if necessary within Block 3, or even relocated to Block 1, near the Wood Mill. If moved, the Machine Shop equipment should be kept as a coherent group, and reinstalled in working order in a layout approximating the real situation. The machine tools should not be installed close to the dirty Blacksmith, Boilermaking or Foundry trades.

Groups MS MT MW MACHINE SHOP - TOOL ROOM - WHEEL SHOP

RECOMMENDATIONS & CONSERVATION POLICY (Continued)

* The machine tools have precisely machined working surfaces, which are sensitive to grit and corrosion, The machines should be oiled or similarly protected against rust, and should be covered against dust while disused, (but not with impervious plastic sheets which will trap moisture inside).

* While some of the machine tools are easily relocated, others are very large and would be expensive and difficult to move, reassemble and realign in full working order. Midland must avoid the situation seen in several other historic workshops, where funds have been readily found for removing machines, but not for reassembling and recommissioning them. We have seen many historically significant and still useful machines, even some of international significance, left rusting in paddocks, and often unnecessarily dismantled or cut into unidentified pieces. Ironically, the buildings from which the machines are removed usually sit empty. Such treatment makes eventual conservation and restoration of the machines much more difficult and expensive.

* The Wheel Shop group should be conserved as a working unit, preferably in situ but at least on site, for its historic association with past Workshops activities, for its ability to demonstrate this important aspect of the Workshops' operations, and as emergency back-up to any future external commercial wheel reconditioning service. Items to be conserved should include (at minimum) the Henry Berry Wheel Press (No.1699), the (modern) Seiki Wheel Lathe (No.3106), and at least one of the Macson Axle Lathes (Nos.2001, 2002, 2004). Special packing blocks, pushing mandrels and lifting aids used with the Berry Press (and similar accessories for the other machines), should be conserved with the group.

* If (as seems likely) the Midland Wheel Shop has to remain in operation temporarily due to lack of outside alternative wheel repair facilities, then it should be kept in situ and in government ownership, and made subject to controls which protect the historically significant equipment against unsympathetic alteration or damage, whether operated by the government or by private contractors under lease.

* The now disused axle burnishing lathe (No.2478), loco crankpin grinding and quartering machine (No.1105), and axle journal grinders (Nos.2041 & 2061) should also be conserved for display, and for repair work on historic locomotives and rolling stock. Preferably all of these machines will be returned to operating condition, and kept in situ or relocated with the rest of the Wheel Shop group.

* Preferably, old wheel lathes, tyre heaters etc., should be obtained from elsewhere to recreate the Wheel Shop as it was in the steam era, for museum display and steam loco repair purposes, with explanation that the equipment is not originally from Midland.

Group MS **MACHINE SHOP - General**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
144	Asquith BOX TABLE for Asquith Radial Drill	45	B	B	C	O
152	Kendall & Gent PLANO-MILLING MACHINE	45	A	A	W	Y
153	Kendall & Gent PLANO-MILLING MACHINE	45	A	A	W	Y
172	Stirk PLANING MACHINE	45	A	A	W	Y
172	Stirk PLANING MACHINE	45	A	A	W	Y
174	CAST-IRON MARKING OUT TABLE	45	A	A	W	Y
174	SCRIBING TOOLS for MARKING-OUT TABLE	45	A	A	W	Y
279	Asquith RADIAL DRILL	52	A	A	W	O
386	Small BENCH GRINDER / PIN LATHE	45	A	A	W	P
1023	Kitchen & Wade 6ft RADIAL DRILL	52	A	A	W	O
1089	Webster Bennett DUPLEX BORING & TURNING MILL	45	A	A	W	O
1111	Denham LATHE	33	B	B	W	O
1120	Cincinnati MILLING MACHINE	45	B	A	W	O
1168	Kitchen & Wade 5ft RADIAL DRILL	47	B	B	W	O
1177	"Hosco" UNIVERSAL MILLING MACHINE & TOOLS	59	A	A	W	O
1177	"Hosco" MILLING MACHINE - CUTTER BOARD	59	A	A	W	O
1200	Regal leBlond CENTRE LATHE	45	C	B	C	O
1201	Hendy CENTRE LATHE	59	C	B	C	O
1207	Town 4-ft RADIAL DRILL	52	B	B	W	P
1235	Macbro PEDESTAL GRINDER	59	B	B	W	O
1258	"Doall" BANDSAW	45	B	B	C	O
1260	Macson SLOTTING MACHINE	45	B	B	W	O
1262	Hercus POWER HACKSAW	59	B	A	W	O
1281	Dean Smith & Grace LATHE	59	B	B	S	O
1296	Dean Smith & Grace LATHE	45	B	B	S	P

Group MS **MACHINE SHOP - General**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1299	Dean Smith & Grace LATHE	59	B	B	S	O
1301	Brackenbury & Austin PLANER	45	B	B	W	Y
1301	Brackenbury & Austin PLANER	45	B	B	W	Y
1302	Butler SLOTTING MACHINE	45	A	A	W	P
1337	"FES" or "LNC" HORIZONTAL BORING MACHINE	45	A	A	W	Y
1337	BORING BARS for HORIZONTAL BORING MACHINE	45	A	A	W	O
1338	McLean PEDESTAL GRINDER	59	B	B	W	O
1362	Asquith 4 ft 6 inch RADIAL DRILL	59	B	B	W	O
1362	PAIR of TROLLEYS on RAILS for Aquith DRILL	59	B	B	W	O
1368	Small DUAL PEDESTAL GRINDER	45	C	B	S	O
1377	Asquith 5 ft 9 inch MOBILE RADIAL DRILL	45	A	A	W	O
1424	Dean Smith & Grace GAP BED LATHE	45	B	A	S	O
1451	Ormerod SHAPER	45	B	A	W	O
1536	Snow SURFACE (RING) GRINDER	45	B	B	W	O
1537	Snow SURFACE (RING) GRINDER	59	C	C	W	O
1543	Hercus 4-inch LATHE	32	B	A	W	R
1609	Kitchen & Wade 2-inch PILLAR DRILL	17	A	A	W	O
1616	"Alba" SHAPER	45	B	A	W	O
1623	Winn SINGLE HEAD SCREW-CUTTING MACHINE	45	B	B	C	O
1625	Ward No.13 COMBINATION TURRET LATHE	45	A	A	W	O
1627	Snow PISTON RING SURFACE GRINDER	45	B	B	H	O
1686	Town 4-ft RADIAL DRILL	45	B	B	W	O
1687	Town 4-ft RADIAL DRILL	45	B	B	S	O
1688	Town 4-ft RADIAL DRILL	45	B	B	S	O
1689	Town 4-ft RADIAL DRILL	45	B	B	S	O

Group MS **MACHINE SHOP - General**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1690	Town 4-ft RADIAL DRILL	46	B	A	W	O
1693	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1694	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1695	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1819	Archdale VERTICAL MILLING MACHINE	45	B	B	W	O
1820	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1824	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1825	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1828	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1834	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1835	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1837	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1838	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1839	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1927	Town 4-ft RADIAL DRILL	59	B	B	S	O
1955	Kendall & Gent VERTICAL MILLER	45	B	B	S	O
1957	Kendall & Gent VERTICAL MILLER	45	B	B	S	O
1958	Joshua Heap SCREWING MACHINE	47	B	B	W	O
1981	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1984	Joshua Heap SCREWING MACHINE	45	B	B	W	O
2009	Butler SLOTTING MACHINE	59	B	B	W	O
2014	Parkson UNIVERSAL MILLING MACHINE	45	C	C	O	
2059	Kendall & Gent PLANO MILLER	45	B	B	W	O
2211	Churchill No.3 INTERNAL CYLINDER GRINDER	45	B	B	W	P
2267	Churchill CRANKSHAFT GRINDER	45	B	A	W	P

Group MS **MACHINE SHOP - General**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2267	RECTIFIER TUBE for CRANKSHAFT GRINDER	82	B	A	W	R
2268	Sunderland GEAR PLANER	45	B	B	W	O
2435	WAGR made BROACHING MACHINE	45	B	B	W	O
2435	BROACHING TOOLS for BROACHING MACHINE	45	B	B	W	O
2543	Dean Smith & Grace CENTRE LATHE	59	C	B	S	O
2731	Dean Smith & Grace CENTRE LATHE	45	C	B	S	O
2792	Bridgeport METAL MILL	17	C	B	W	R
3004	Sheraton METAL WORKING LATHE	17	C	B	W	O
3252	"British Made" POST (or PILLAR) DRILL	31	A	A	D	R
3305	Mori Seiki COMPUTER CONTROLLED LATHE	45	C	B	S	O
8093	TILTING BOX TABLE (possibly Kitchen & Wade)	45	B	A	W	O
8205	WOODEN "PYRAMID" holding CHANGE GEARS	45	B	B	W	O
8207	Group of SMALL SCREW JACKS	45	B	A	W	O
8209	CAST-IRON MARKING OUT TABLE	45	A	A	W	O

Group MT **MACHINE SHOP - TOOLMAKING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1098	Cincinnati TOOL & CUTTER GRINDER	45	B		W	O
1224	Jones & Lamson THREAD GRINDING MACHINE	45	B	B	W	O
1249	Churchill UNIVERSAL GRINDER	45	C	B	W	O
1250	Churchill SURFACE or RING GRINDER	45	B	B	W	O
1251	Macson TOOL & CUTTER GRINDER	45	B	B	W	O
1357	Churchill SURFACE GRINDER	45	B	B	W	O
1624	Cincinnati "Hydrotel" VERTICAL MILLER	45	B	A	W	O
2154	Cincinnati "Monoset" TOOL & CUTTER GRINDER	45	B	B	W	O
2191	Cincinnati TOOL & DIE MILLING MACHINE	45	B	B	W	O
2203	Butler PRECISION TOOLROOM SLOTTER	59	B	B	W	O
8202	WAGR made DEMAGNETISER in WOODEN CASE	45	B	B	W	O

Group MW **MACHINE SHOP - WHEEL SHOP SECTION**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1105	Craven CRANKPIN QUARTERING MACHINE	95	A	A	W	R
1417	Webster & Bennett TWIN HEAD VERTICAL BORER	45	B	A	W	O
1699	Henry Berry 400-ton HYDRAULIC WHEEL PRESS	45	A	A	W	Y
1699	Henry Berry 400-ton HYDRAULIC WHEEL PRESS	45	A	A	W	Y
2001	Macson AXLE LATHE	45	B	A	S	P
2002	Macson AXLE LATHE	45	B	A	S	P
2004	Macson AXLE LATHE	45	B	A	S	P
2041	Churchill LOCOMOTIVE AXLE JOURNAL GRINDER	45	A	A	W	P
2061	Churchill CAR & WAGON AXLE JOURNAL GRINDER	66	A	A	W	R
2061	COMPONENTS of C & W AXLE JOURNAL GRINDER	66	A	A	W	R
2061	FACEPLATE for C & W AXLE JOURNAL GRINDER	66	A	A	W	R
2061	WHEEL-SET LIFTER for JOURNAL GRINDER	66	A	A	W	R
2061	West CONTROL CABINET for JOURNAL GRINDER	66	A	A	W	R
2478	MFD-Dortmund AXLE BURNISHING LATHE	45	B	A	W	P
3106	Hitachi Seiki WHEEL LATHE	45	C	A	W	P
8232	"WHEEL SHOP" SIGN	45	B	A	D	P
8260	STEEL TYRES FOR CAR & WAGON WHEELS	90	A	A	D	R

Group PM PLANT MAINTENANCE

SUMMARY

A small team of tradesmen, mostly fitters and plumbers, was responsible for maintenance of the various machine tools, pumps, cranes etc, throughout the Workshops. They used a variety of equipment, most of which has been listed in the inventory under the trade group to which it is related (eg lathes and milling machines under Group MS). However, a number of minor items peculiar to maintenance work have been listed under Group PM. These include mobile workbenches (Nos. 8058 & 8178) which could be taken to the machine being repaired, and motorised tricycles (No.3594) used by maintenance fitters to get around the large Workshops site.

These are recommended for conservation as representative of the maintenance tradesmen who kept the Workshops equipment in running order, and as evocative of the people involved in that task, rather than just the major machines they used.

SIGNIFICANCE

Items related to Plant Maintenance (Group PM), are significant for reasons including the following:

* As a group, they represent the fact that this large Workshops complex devoted to maintenance of rolling stock, itself needed maintenance, and that this was achieved mainly by skilled tradesmen using relatively modest equipment.

* Two items, Mobile Workbench No.8058 and Post Vyce No.8081, are of particular significance as examples of early plant maintenance equipment (estimated c1904 or c1910) which have survived in unusually intact condition.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the various Plant Maintenance items listed in the Inventory, for display in the Workshops Museum.

Group PM **PLANT MAINTENANCE**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
3594	MOTORISED TRICYCLE	47	B	B	S	R
8058	MOBILE TOOL-BOX & WORKBENCH	26	A	A	W	R
8070	Dawn BENCH VYCE	22	C	B	W	Y
8081	John Brooks LARGE POST VYCE with STAND	22	A	A	W	P
8178	WOODEN MOBILE TOOL-BOX & WORKBENCH	59	B	A	W	O

Group PL PLATING SHOP

SUMMARY and SIGNIFICANCE

Since the 1930s or earlier, Midland Workshops has had a Plating Shop for electroplating metal components (carriage door handles, window latches, etc.). This was originally located in Building No.32, but in c1973 was relocated to the present Building No.31. Due to the corrosive nature of the plating chemicals, the plating baths and equipment have been replaced frequently, and are relatively new. They would also be difficult to conserve. Consequently, the Plating Shop items (Group PL) were not considered of sufficient heritage significance collectively to warrant conservation as a group. However two items of auxiliary plant have been included in the inventory under other groups, namely Item 8245, an AC/DC rotary converter included in Group EL, and Item 3252, a post drill included in Group MS.

RECOMMENDATIONS & CONSERVATION POLICY

* It is recommended that samples of electroplated railway components be collected for display in the Workshops Museum, to represent and interpret the past role of the Plating Shop.

Group PT PAINTING

SUMMARY

When Midland Workshops was established, painting (and varnishing) was a major task in the maintenance of rolling stock, especially the predominantly wooden bodied wagons and carriages which had to withstand prolonged exposure to sun or rain. The use of more durable materials for the body of rolling stock has improved their natural resistance to decay, and reduced the need for painting. Painting is still an important part of the Workshops' activities, but now using pre-manufactured paints applied by modern spray gun methods. Indeed, the set-up for painting wagons and locos, and for grit-blasting them in preparation for painting, looks as though it is state-of-the-art today, and probably commercially competitive.

The original lists of workshops equipment c1904 included plant for grinding paint pigments and mixing paint on site, which was the standard practice in major workshops of the day. The lists also included some quite early spray painting equipment. None of the early paint shop equipment appears to have survived, other than a small manual pigment grinder and even that appears to be later and smaller than would have been used originally. The other Paint Shop items of heritage interest were small paint-brush aids, some painted signs, and some perforated "pouncers" used as patterns for the signs. These are recommended for conservation as a small but interesting remnant from this important but often overlooked aspect of the Workshops activities.

Group PT **PAINTING**

SIGNIFICANCE

Items related to the Paint Shop (Group PT), are significant for reasons including the following:

* The large collection of paint brushes and solvent tins (No.8157), although modern, is suitable for display as representing the manual painting techniques extensively used in the original Paint Shop.

* The small manual pigment mill (No.8156) is a modest but significant reminder of the time when the Workshops had to grind its own pigments and mix its own paints.

* The various painted signs, and the cartoons or "pouncers" for marking out the signs (No.8158) are significant in representing the more skilled signwriting aspects of the Paint Shop, and in their association with several historic and/or well known trains.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the paint brushes and tins (no.8157), the pigment mill (No.8156), and the various signs and pouncers (No.8158) in a secure place, for eventual display as part of the Workshops Museum.

* If possible, find and conserve paint colour samples and paint formulations used in the days when paints were made on site.

Group PT **PAINTING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8156	PAINT PIGMENT MILL	64	A	A	D	O
8157	"TIN" CANISTER for VARNISH BRUSHES	64	A	A	D	O
8157	PAINT STORE HATCH	64			H	Y
8157	PAINTING EQUIPMENT, BRUSHES, CANS etc.	64	B	B	D	O
8158	COLLECTION of "POUNCERS"	64	A	A	A	R
8158	COLLECTION of SIGNS & BADGES	64	B	A	D	R
8158	SAMPLE PAINTED TRAIN SIGN	64	B	A	D	O

Group QC QUALITY CONTROL

SUMMARY

Midland had three main centres related to quality control procedures and plant, namely the Test House, the Laboratory, and the Metrology Room in the Toolroom Store. These did precision metrology on tools and components, or physical and chemical tests on a variety of materials, for the Workshops, for the Railways, and for other (mostly government) clients. An extensive array of equipment from these three areas has been listed in the Inventory, under Group QC, and could make an interesting working display as part of the Workshop Museum.

Wherever it is kept on site, the QC Group of equipment from the Laboratory, Test House and Metrology Room should be housed in a very secure area. Unlike most railway workshop equipment, items in the QC Group are delicate and very vulnerable to vandalism. Also, many of the items are small and easily stolen, and would be attractive to antique collectors.

SUMMARY - THE TEST HOUSE

The Test House is concerned with testing the mechanical properties of materials and components, such as tensile strength, compressive strength, hardness, toughness, etc.. It was originally located in a shed west of the C.M.E.'s Office, but is now housed in Building 54, which was at various times a paint store and/or paint mixing area, an upholstery shop, and possibly an accounting office. The Test House has good examples of standard testing machines, and some unusual ones, including a 1902 "Buckton" hydraulically powered chain testing machine (Item 456), a modern set of standard dip-sticks (No.8126), and an old set of engraved "Avery" standard brass weights (Item 8125).

The Test House equipment ranges in age from 1902 to the 1970s. All major items were recently checked and recertified as operable and accurate. All or most of the Test House equipment should be conserved together as a comprehensive working group representing a wide range of physical testing methods used over the last 90 years. The group may also have ongoing viability as a contract testing facility for W.A. industry, or an educational facility for W.A. tertiary technical colleges and universities.

The Test House equipment was fairly recently relocated to its present site in Building 54. If necessary, the equipment could be relocated again to some other building on site without serious loss of significance, provided the plant is all relocated together and reinstalled in working order, including the small "Victoria" overhead crane (Item 8123) serving the Buckton. If relocated, note that the Buckton (Item 456) has a sliding bed, and should be given sufficient spare space at the end remote from the ram (without having to cut a hole in the end wall, as in the present location). Also note that the Izod Impact Tester (Item 2783) needs space and protective barriers for safe swinging of the heavy hammer arm. Ideally, the Buckton should be reconnected to the high-pressure water hydraulics supply, as it was originally (instead of the present oil hydraulic system), and this should be kept in mind if the plant is relocated.

Group QC **QUALITY CONTROL**

SUMMARY - THE LABORATORY

The Laboratory evaluates the chemical and physical properties of materials, such as coal, oil, solvents, etc.. The Laboratory has a few items of equipment of considerable age and/or heritage significance, which are recommended for conservation and display, as noted in the inventory sheets for Group QC. These items include a flash point instrument (Item 8170) certified in London in 1897, under Queen Victoria's reign, a manual-powered centrifuge (Item 8173), and a specialised Loco Fusible Plug tester (Item 8177) which played a significant role in ensuring the safety of steam locomotive boilers.

Most of the Laboratory equipment is modern routine chemical analysis apparatus of little heritage significance. However, it would be desirable to keep samples of the more modern laboratory equipment to add ambience and visitor interest to any display of the rather meagre group of historic laboratory items.

The Laboratory was originally located in a shed at about the site of the War Memorial Statue, but in the 1920s was relocated to its present purpose-built brick building (No.2) between the C.M.E.s Office and the Railway Institute. If necessary, the small amount of significant laboratory equipment to be conserved could be relocated elsewhere on site, to some small building or small room in a larger building, in order to free up the present site for other uses.

SUMMARY - THE METROLOGY ROOM

The Toolroom (see Group MT) had associated with it a Metrology Room equipped to make very precise measurement of the dimensions and shape of cutting tools, and of the gauges made in the Toolroom for checking other Workshops products. Although the Workshops always had some precision measuring equipment, the Metrology Room underwent major upgrading during and soon after WW2 - partly to support munitions manufacture and partly during the general Workshop post-war reconstruction programme. It was then seen as the principal metrology facility in W.A.. The group is recommended for conservation as an unusually comprehensive and intact collection of precision metrology equipment of the 1940s and 1950s. Such a collection is now rare - especially as it is mostly imperial inch-based measuring equipment which private industry would have long ago discarded as obsolete, following the conversion to metric measurement.

The future commercial viability of the Metrology Room is limited, in that measurements would be made in imperial units, and generally would have to be converted to metric units for current industrial use. However, there may still be a niche market for imperial measurement of old equipment, or measurement of recent equipment from UK or USA where imperial units are still widely used. Also, the straightness/concentricity tester and the shadowgraph profile-checking instruments are still useful regardless of which length units are used.

Group QC QUALITY CONTROL

SIGNIFICANCE

Items related to Quality Control (Group QC), found mainly in the Test Room, the Laboratory or the Metrology Room, are significant for reasons including the following:

* The Test House equipment as a group represents a commitment to scientific testing of Workshops materials and products since the establishment of the Midland Workshops, and continuing up to the present day. The existing equipment primarily represents a typical mechanical test laboratory of c1950s, but includes some quite modern machines with current calibration approval, and must constitute one of the best such facilities in W.A.

* The 1902 Buckton tension/compression tester (No.456) is of particular significance, as the only one of the original 1902 Test House machines to survive, as a rare type of test machine still in intact working order after 90 years of service, and as one of the few 1902 hydraulically powered machines still at Midland (albeit now running on oil instead of water).

* The Laboratory equipment represents a commitment to scientific testing of materials since at least c1912, although only a few items of equipment approach that age. The listed items of laboratory apparatus could be used to represent evolving laboratory equipment over the last 80 to 100 years.

* The most notable individual items of laboratory equipment are the Abel Flash Point Instrument, No.8170, dated 1897, and the specialised Locomotive Fusible Plug Tester (No.8177, undated). Several other items are of high or very high significance, as listed in the Inventory.

* The majority of Laboratory apparatus not listed in the Inventory, is relatively modern routine chemical laboratory apparatus, which however would be fairly similar to that used 50 or 80 years ago.

* The majority of the Toolroom Metrology Room equipment constitutes a top-quality metrology centre of c1940s or 1950s, and represents the great upgrading in precision measuring ability introduced during or soon after the Second World War. It still represents a valuable precision metrology facility for W.A., although many measurements would have to be converted from inches to millimetres.

* The Cussons Profile Projector (No.1285), nominally obtained 1943, represents an earlier style of precision toolroom metrology device, and may in fact be older than the 1943 date indicated on the Plant Card. With its quaint styling, large screen and obvious action, it has considerable potential value for museum demonstration of profile measuring methods.

Group QC **QUALITY CONTROL**

SIGNIFICANCE (Continued)

* The Toolroom Store and Metrology Room hold a large number of imperial (inch) micrometers and verniers of various sizes and types which were commonly used in machine shops prior to metrication, but are now becoming rare. These are significant as representing the British-based measuring system used at Midland (and throughout Australian industry) during most of the Workshops' life, including virtually all of the steam era. These instruments have potential value as aids for interpreting the imperial system to visiting children who have only known metric measurements, and possibly for repair or remanufacture of components made originally to inch dimensions.

* The Toolroom Store holds a large number of precise metal GO NO-GO gauges for checking a wide variety of dimensions and features on products made in the Machine Shop in the past. These gauges typify an important inspection method widely used in manufacturing machine shops throughout this century, and represent one of the main products of the Toolroom, apart from cutting tools. They have potential value for demonstration of this inspection technique, and possibly for manufacture of spare parts for historical rolling stock, to original dimensional tolerances.

* A rack of paint test samples exposed to the weather (No.8010) has significance as a highly visible and easily interpreted example of a laboratory test, which also signifies ongoing concern about the durability of paints, which must also have been a concern even before the Workshops was established. The test rack also has potential to yield further information about the specimens still under test, some of which look as though they have accumulated years of test exposure.

Group QC **QUALITY CONTROL**

RECOMMENDATIONS & CONSERVATION POLICY

* The Test House equipment listed as significant in the Inventory, including the 1902 Buckton chain tester (No.456), the various test machines of the c1940s, c1950s and c1960s, and the ornate standard masses (weights), should be conserved together for display as a comprehensive working group representing a wide range of physical testing methods over the last 90 years. Associated test specimens, specimen holders, manuals, test record books, etc., should also be conserved with the machines. The small attractive items (eg brass weights) should be kept in strong locked cupboards, and the whole Test House should be made more secure.

* The Test House group may also have ongoing viability as a contract testing facility for W.A. industry, or an educational facility for W.A. tertiary technical colleges and universities, in which case the more modern universal test machine (No.3179) should also be conserved with the group to improve the group commercial viability.

* The Test House equipment was fairly recently relocated to its present site in Building 54. If necessary, the equipment could be relocated again to some other building on site without serious loss of significance, provided the plant is all relocated together and reinstalled in working order.

* The 1902 Buckton tension/compression tester (No.456) is of particular interest as a machine to demonstrate testing methods in a museum context. Consideration should be given to relocating it where it can be easily and safely watched by spectators, especially if the Test Room is to be relocated anyway. Conversion back to water operation should also be considered.

* The listed items of laboratory apparatus should be conserved, and used in a demonstration of scientific aspects of Midland's work, and the scientific service provided to the rest of the railways.

* The most notable individual items of laboratory equipment are the Abel Flash Point Instrument, (No.8170), dated 1897, and the specialised Locomotive Fusible Plug Tester (No.8177), undated. Several other items are of high or very high significance, as listed in the Inventory.

* The majority of Laboratory apparatus not listed in the Inventory, is relatively modern routine chemical laboratory apparatus, which however would be fairly similar to that used 50 or 80 years ago.

Group QC **QUALITY CONTROL**

RECOMMENDATIONS & CONSERVATION POLICY (Continued)

* The majority of the Toolroom Metrology Room equipment constitutes a top-quality metrology centre of c1940s or 1950s, and represents the great upgrading in precision measuring ability introduced during or soon after the Second World War. It still represents a valuable precision metrology facility for W.A., although many measurements would have to be converted from inches to millimetres.

* The Cussons Profile Projector (No.1285), nominally obtained 1943, is significant as representing a much earlier style of precision toolroom metrology device, and may in fact be older than the 1943 date indicated on the Plant Card. With its quaint styling, large screen and obvious action, it has considerable potential value for museum demonstration of profile measuring methods.

* The Toolroom Store and Metrology Room hold a large number of imperial (inch) micrometers and verniers of various sizes and types which were commonly used in machine shops prior to metrication, but are now becoming rare. These are significant as representing the British-based measuring system used at Midland (and throughout Australian industry) during most of the Workshops' life, including virtually all of the steam era. These instruments have potential value as aids for interpreting the imperial system to visiting children who have only known metric measurements, and possibly for repair or remanufacture of components made originally to inch dimensions.

* The Toolroom Store holds a large number of precise metal GO NO-GO gauges for checking a wide variety of dimensions and features on products made in the Machine Shop in the past. These gauges typify an important inspection method widely used in manufacturing machine shops throughout this century, and represent one of the main products of the Toolroom, apart from cutting tools. They have potential value for demonstration of this inspection technique, and possibly for manufacture of spare parts for historical rolling stock, to original dimensional tolerances.

* A rack of paint test samples exposed to the weather (No.8010) has significance as a highly visible and easily interpreted example of a laboratory test, which also signifies ongoing concern about the durability of paints, which must also have been a concern even before the Workshops was established. The test rack also has potential to yield further information about the specimens still under test, some of which look as though they have accumulated years of test exposure.

* Much of the QC items are small and/or delicate and/or valuable and/or attractive. This Group needs special care to keep the items secure against theft and vandalism, by locking small items in strong secure cupboards, and by ensuring the rooms containing the apparatus are also very secure.

Group QC QUALITY CONTROL (Inspection, Measurement, Testing, Laboratory)

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
456	J.Buckton 40-ton CHAIN & COMPRESSION TESTER	54	A	A	W	O
456	J.Buckton 40-ton CHAIN & COMPRESSION TESTER	54	A	A	W	O
1263	Avery HARDNESS TESTER TYPE 1410	45	B	A	W	O
1285	Cussons PROFILE PROJECTOR	45	A	A	W	R
1285	Cussons PROFILE PROJECTOR SCREEN	45	A	A	W	R
1285	SCRIBED THREAD-PROFILE TEMPLATES	45	A	A	W	R
1286	(Newall ?) LENGTH MEASURING MACHINE	45	A	A	D	O
1289	Firth HARDOMETER	54	A	A	W	O
1290	WAGR Budenberg PRESSURE GAUGE TESTER	54	A	A	W	O
1539	Avery ROCKWELL HARDNESS TESTER	54	B	A	W	O
1619	Avery UNIVERSAL TESTING MACHINE	54	B	A	W	O
2286	Newall LENGTH MEASURING MACHINE	45	B	A	W	O
2357	Societe Genevoise PROFILE PROJECTOR	45	B	A	W	O
2783	Avery IZOD (IMPACT) TESTER	54	C	A	W	O
2783	GO / NO-GO GAUGES for Avery (IZOD) TESTER	54	C	A	W	O
3179	Avery-Denison UNIVERSAL TESTER	54	C	B	C	O
3241	Wing CENTRES MACHINE	45	B	A	W	O
8010	PAINT TEST SAMPLES	90	B	A	W	R
8117	Hounsfield EXTENSOMETER	54	B	A	W	O
8118	0-100 DUROMETER TESTER	54	B	A	W	O
8119	Pulsometer Co. SMALL MANUAL PUMP	54			H	O
8120	Hounsfield TENSOMETER	54	B	A	W	O
8121	INSTRUMENTS & GAUGES in Chest of Drawers	54	B	A	W	O
8124	GLASS FRONTED CABINET & CONTENTS	54	A	A	D	R
8125	Avery BRASS WEIGHTS & fitted WOOD TRUNK	54	A	A	D	R

Group QC QUALITY CONTROL (Inspection, Measurement, Testing, Laboratory)

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8125	Avery 25kg BRASS WEIGHT (largest of the set)	54	A	A	D	R
8126	Set of STANDARD CALIBRATION DIPSTICKS	54	C	C	C	O
8127	Ashcroft STEAM ENGINE INDICATOR	54	A	A	D	O
8128	Dennert & Pape PLANIMETER	54			H	O
8170	ABEL FLASH POINT MEASURING INSTRUMENT	2	A	A	D	O
8171	CARBON TRAIN FURNACE & TRANSFORMER	2	B	B	D	O
8172	LABORATORY INSTRUMENTS in Cupboard	2	B	B	D	O
8173	CENTRIFUGE	2	A	A	W	O
8174	VACUUM PUMP	2	A	A	W	O
8175	Dieter-Gibson FOUNDRY CONTROL EQUIPMENT	2	B	A	W	O
8176	SAND-COMPACTOR	2	B	A	W	O
8177	(STEAM) LOCOMOTIVE FUSIBLE PLUG TESTER	2	A	A	D	O
8183	MICROMETERS & VERNIERS in Chest of Drawers	45	B	A	W	P
8198	GO / NO-GO GAUGES & TEMPLATES	45	A	A	W	O
8198	TEMPLATES & PROFILE GAUGES	45	A	A	W	R
8198	TEMPLATES & PROFILE GAUGES	45	A	A	W	R
8199	Junghans TIMER	45	B	B	W	O
8200	INCH MICROMETERS & VERNIERS in cupboard	45	B	A	W	O
8201	Windley STRAIGHT EDGE (10 feet long)	45	B	A	W	O

Group RS ROLLING STOCK - Assembly & Repair

SUMMARY

The Rolling Stock Group RS includes specialised equipment for servicing locos, carriages, wagons.

Although the main function of the Workshops was the maintenance and repair of rolling stock, most of the equipment was of a general-purpose nature commonly associated with normal industrial trades, and has been listed in the inventory under those trades. However, there were some specialised items specific to rolling stock manufacture or repair, and a few such items considered of historic significance have been listed in the inventory under Group RS. These are significant mainly for their rarity and their specialised association with rolling stock, although the Fairbanks (Steam) Locomotive Weighbridge (No.545) is also of considerable age, having been installed as part of the original Workshops.

The specialised Fairbanks Loco Weighbridge (No.545) was imported from Vermont USA in 1902, and is still installed in a pit under the floor of the northern half of Shed 28, although now covered by a false wooden floor and difficult to see. It was used to measure the load on the rails beneath each axle of a steam locomotive, to ensure that the weight distribution of the locomotive components and the relative setting of the various axle bearings and springs did not put excessive load on the rails at any one axle, as that could overstress the rails and reduce the traction at other axles. It is a rare and important relic from steam loco workshop days, and should be conserved in situ.

A c1904 specialised Pooley car & wagon weighbridge is listed in plant records, but was not found. It possibly is or was also under the floor of the Loco Weighbridge Shed (28), in the adjoining bay south of the Fairbanks.

Two other 1950s machines are listed under Group RS. The Horn Block Grinding Machine (No.2221), which trues up the alignment of bogie mounting surfaces on a carriage or wagon chassis, remained in use up to 1993, and probably could have ongoing use. A disused Radius Link Bolt Grinder (No.1980), is also listed. Its function was not clear, but it probably machined precise sliding surfaces on some steam locomotive linkage components.

Also listed under Group RS is a timber-bodied guards van or brake van seen in the Salvage Yard, of the type which would have been made and maintained at Midland.

Group RS **ROLLING STOCK - Assembly & Repair**

SIGNIFICANCE

Items related to Rolling Stock & its Maintenance and repair (Group RS), are significant for reasons including the following:

* The Fairbanks Locomotive Weighbridge (No.545) has very high significance as a rare machine, specific to the construction and/or repair of steam locomotives, which has been at Midland Workshops since its establishment in 1904. It contributed to the safe and efficient running of W.A. steam locos for about 60 years, and appears to be still complete and in original working order. It also has significance as potentially of use for future maintenance or adjustment of historic steam locomotives, to enable them to run on the State rail network without overstressing the rails.

* The Pooley Car & Wagon Weighbridge (if it still exists) would also be of very high significance as a specialised device used to check thousands of carriages and wagons.

* The Horn Block Grinder (No.2221), and probably the Double Radius Link Bolt Grinder (No.1980), is/are significant as rare special-pupose machine tools for making or repairing rolling stock.

* The wooden-bodied van (No.8151) is significant as typical of the hundreds of wooden-bodied vans and carriages made and/or maintained at Midland.

Group RS **ROLLING STOCK - Assembly & Repair**

RECOMMENDATIONS & CONSERVATION POLICY

* The Fairbanks Locomotive Weighbridge (No.545) should be conserved in situ, and returned to operating condition. The false flooring in the northern bay of the weighbridge shed should be removed to expose the weighbridge to view. The rail access should be restored and/or maintained to the shed, to enable the weighbridge to be used in future for demonstration, and to check historic steam locomotives undergoing restoration. Deteriorated parts of the weighbridge shed should be repaired, to secure the weighbridge against weather and vandalism. The adjoining southern bay of the shed should be investigated, to see whether the Pooley carriage and wagon weighbridge is beneath the floor.

* The Double Radius Link Bolt Grinder (No.1980) should be conserved for further investigation, and probably for display as a specialised machine tool in the Workshops Museum.

* The Horn Block Grinder (No.2221) should be conserved for display as a specialised machine tool in the Workshops Museum, preferably in situ, but available for ongoing maintenance work on rolling stock under contract if the work cannot be done by any other workshop.

* The wooden bodied van (No.8151), or equivalents, should be conserved on site for display in conjunction with the Workshops Museum as an example of the type of vehicle built and maintained at the Workshops.

Group RS **ROLLING STOCK - Assembly & Repair**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
1980	Churchill DOUBLE RADIUS LINK BOLT GRINDE	45	B	A	W	P
2221	Churchill HORN BLOCK GRINDING MACHINE	45	A	A	W	P
8094	FITTER'S WORKBENCH & VYCE	47	A	A	D	O
8151	WOODEN BRAKE-VAN or GUARD'S VAN	74	B	A	D	R

Group SI SITE FEATURES (other than buildings)

SUMMARY

Group SI covers a small number of outdoor artefacts which are not associated with particular trade groups, but which are listed in the inventory as significant artefacts warranting conservation due to their association with past Workshops activities, their technical interest, and/or their value as site features. These include a circular riveted iron tank (No.8008), a square cast iron tank (No.8007), a pair of stone mounds associated with the original septic sewerage system (No.8006), and a cast iron post (No.8066) from a former fence near the Railway Institute.

SIGNIFICANCE

Some miscellaneous site features, other than buildings (Group SI), are significant for reasons including the following:

* The wooden van now used as an office or lunchroom (No.8003) is significant partly as an example of the wooden-bodied vehicles made or repaired at Midland, but mainly as an example of (unofficial?) employee amenities.

* The stone mounds (No.8006) are significant as the visible remains of an early c1904 septic sewerage system serving the Workshops.

* The circular and square tanks (Nos.8007 and 8008) are visually interesting as site features. The square cast iron tank is also significant as an example of the modular cast-iron tanks widely used for watering steam locomotives, and possibly as the tank originally used at Midland c1902 to collect bore water.

* The cast-iron fence post (No.8066) is significant as the last remnant of the decorative fence which was outside the Institute (and as pattern for the possible replication of the fence). Reputedly, the same style of fence post was made at Midland Foundry for the Perth Railway Station. The post is also significant as an early example of a product of the Midland Foundry, and has the WAGR Foundry badge cast into its base (below present ground level).

Group SI **SITE FEATURES (other than buildings)**

RECOMMENDATIONS & CONSERVATION POLICY

* The wooden van (No.8003) should be left in situ as an interpretative aid and/or a staff facility, in association with a display of the Foundry.

* The stone mounds (No.8006) should be kept in situ, for interpretation as the only visible remains of the early c1904 septic sewerage system serving the Workshops. They should be left in their present condition, other than for any stabilisation work needed to prevent further collapse.

* The circular and square tanks (Nos.8007 and 8008) should be retained as visually interesting site features. If necessary, the tanks could be relocated on site. The square cast iron tank should be further researched to determine whether it was the tank originally used at Midland c1902 to collect bore water; if so it could validly be relocated to the east side of the Powerhouse as shown on early site drawings.

* The cast-iron fence post (No.8066) could be replicated to reproduce the former post-and-chain fence outside the Institute. If so, then the original post (which has the WAGR Foundry badge on its base) should be removed and used in the museum display of the Foundry, as an early foundry product.

Group SI **SITE FEATURES (other than buildings)**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8003	WOODEN BRAKE-VAN or GUARD'S VAN	14	B	A	D	O
8006	2 SEPTIC-SYSTEM AERATION ROCKPILES	94	A	A	D	Y
8006	Detail of SEPTIC-SYSTEM AERATION ROCKPILE	94	A	A	D	Y
8006	Detail of SEPTIC SYSTEM AERATION ROCKPILE	94	A	A	D	Y
8007	SQUARE CAST-IRON TANK - Interior Detail	93	A	A	W	O
8008	ELEVATED CIRCULAR RIVETED STEEL TANK	34	A	A	W	P
8066	SQUARE SECTION CAST-IRON FENCE POST	90	A	A	D	Y
8258	COAL LOADER CRANE RAILS	92	B	B	D	Y
8261	RAIL TRACKS and SWITCH POINTS in Yard	90	A		W	F

Group SM SHEET METAL

SUMMARY

Midland Workshops had a team of tinsmiths and coppersmiths cutting, shaping and joining sheet metal to make carriage fittings, plumbing components, toolboxes, oilcans, etc. They used a variety of tools, mostly small and manually powered, suitable for the light-gauge sheet metal they handled. The coppersmiths' and tinsmiths' tools were amongst the first equipment bought for Midland. In fact much of it was bought in 1896, before Midland was built, and so the equipment was used at Fremantle Workshops for about eight years before the workshops were transferred to Midland.

Small-scale manual sheet metal equipment has changed very little in the last 100 years, and much of the 1896 equipment was still in use in 1993, although supplemented with some more modern powered equipment as well. The Inventory lists a large number of mostly small sheet metal tools considered to be of heritage significance. Most of the sheet metal tools were found in the Coppersmiths Shop, but some were found in other Shops as well, such as the Heavy Vehicle Maintenance Shop. This equipment is of very high significance and should be conserved as a group, representing a virtually intact sheet metal shop of nearly a century ago, and still in working order.

The sheet metal equipment is very suitable for a working museum, being easy and cheap to operate and demonstrate, and able to make objects which could be attractive to visitors to see and purchase. However, the equipment needs to be kept in a secure area, as much of it is light and easily carried away, and would be attractive to home handymen or to antique collectors.

Group SM **SHEET METAL**

SIGNIFICANCE

Items related to Sheet Metal Work (Group SM), are significant for reasons including the following:

* The group of c1890s and c1900s manual tools have survived as an unusually comprehensive and almost intact collection of late 19th century sheet metal shop tools, still operable and viable for short-run jobs after nearly 100 years of industrial use.

* The later sheet metal tools listed in the Inventory complement the older ones, and make the overall group more complete and more viable for demonstration or for commercial use. Several of the c1950s or 1960s machines are very similar to those of 1890s, and demonstrate how little the technology has changed.

* The various sheet metal objects listed in the Inventory (oil cans, rubbish bins, etc.) are significant as products of the Coppersmiths or Tinsmiths Shop which can still be related to the actual tools that made them, as typical examples of the craftsmanship and style of the day, and as evidence of the effort and care devoted to making even mundane objects which would today be mass-produced by machine or as plastic mouldings.

* The whole Group has significance as representing a very old but now rapidly vanishing trade, and as offering excellent potential for conserving and demonstrating the Coppersmiths' and Tinsmiths' craft.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve the inventoried sheet metal tools, benches etc., as a group, some for static display and some for working demonstration as part of a Workshops Museum. Make sure small components are kept, eg. the loose rollers (No.8045), seen in a bin on the floor of the Coppersmith Shop. Conserve samples of sheet metal products made in the Shop, for incorporation in the display.

* Collect the tools, sheet metal products, etc., from around the Workshops and keep them in one secure building (not necessarily the present Coppersmith Shop), to prevent disposal or theft.

* Record in detail the method of using the various tools and the particular types of job each was used for. This will rely largely on verbal advice or demonstration by the former Coppershop employees, if willing.

Group SM **SHEET METAL**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
410	PANING DOWN MACHINE	23	A	A	W	R
411	Rhodes GUILLOTINE with Foot Treadle	23	A	A	W	R
415	SCREW or FLY PRESS (TIN PUNCH)	23	A	A	W	R
555	Buck & Hickman 20-inch 3-ROLL BENDING ROLLS	23	A	A	W	R
829	20-inch FOLDING MACHINE	23	A	A	W	R
831	30-inch 3-ROLL BENDING ROLLS	23	A	A	W	R
832	BEADING MACHINE	23	A	A	W	R
833	THICK-EDGE or TURN-UP MACHINE	23	A	A	W	R
834	SWAGING or BEADING MACHINE	23	B	A	W	R
836	SWAGING or BEADING MACHINE	23	A	A	W	R
838	36-inch FOLDING MACHINE	23	A	A	W	R
839	PANING DOWN MACHINE	23	A	A	W	R
841	TURN-UP or WIRING MACHINE	23	A	A	W	R
842	BEADING or SWAGING MACHINE	57	A	A	W	R
844	JENNY or BURRING (CREASING) MACHINE	23	A	A	W	R
868	Heine 6-ft GUILLOTINE	23	B	A	W	R
1354	Hercus HEAVY DUTY POST DRILL	23	B	A	W	R
1519	John Heine BURRING MACHINE or JENNY	57	B	A	W	R
1573	"Justice" CIRCLE CUTTING MACHINE	23	A	A	W	R
1574	John Heine PANING DOWN MACHINE	23	B	A	W	R
1578	"Justice" HEAVY DUTY JENNY (aka THICK EDGE)	23	A	A	W	R
1590	"Justice" MEDIUM DUTY TURN-UP or WIRING Mach.	23	B	A	W	R
1642	Tate 6-ft HAND CURVING ROLLS	52	C	B	W	R
1990	WAGR made 3-roll 6-ft BENDING ROLLS	57	A	A	W	R
2483	John Heine 3-ft MANUAL FOLDER Model 25H	57	B	B	W	R

Group SM **SHEET METAL**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2524	PANEL WHEELING MACHINE	24	B	B	W	O
8016	COPPERSMITHS DIVIDERS & DEPTH SCRIBERS	23	A	A	W	R
8022	BURRING MACHINE or JENNY	23	C	C	O	
8023	COPPERSMITH'S SAMPLES on Display Board	23	A	A	D	R
8042	McPherson's BEADING or SWAGING MACHINE	57	B	B	W	R
8043	PUNCHING & STENCILLING MACHINE	23	B	B	W	O
8044	COPPERSMITH'S HAND TOOLS	23	A	A	W	R
8044	COPPERSMITH'S HAND TOOLS	57	A	A	W	R
8044	COPPERSMITH'S HAND TOOLS and WORKBENCH	57	A	A	W	R
8045	ROLLERS for BEADING & SWAGING MACHINES	23	A	A	W	R
8046	COPPERSMITH'S HAND TOOLS on Labelled Shelves	23	A	A	W	R
8047	COPPERSMITH'S WORKBENCH with Bench Plate	23	A	A	W	R
8048	WOODEN LOG with SHAPED END	23	A	A	W	R
8049	CONICAL CAST-IRON MANDREL	23	A	A	W	R
8050	3-roll BENDING ROLLS	23	A	A	W	R
8052	BRACKET for BENDING TAILS on PIPE JOINTS	23	B	B	W	R
8053	BRACKET with SMALL PIPE-BENDING ROLLS	23	B	B	W	R
8057	STOCK SHEARS (TIN SNIPS)	26	A	A	W	R
8059	ROSIN POT HEATING STOVE & ROSIN (in drum)	23	A	A	W	P
8065	WAGR made OIL BOTTLE	45	B	B	D	O
8065	WAGR made OILCANS & OIL BOTTLE	84	A	A	D	R
8074	WAGR made GALVANISED-IRON RUBBISH BIN	22	A	A	D	R
8107	BOTTOM CLOSING MACHINE	23	A	A	W	R
8159	WAGR made "St JOHN AMBULANCE" BOX	22	A	A	D	O
8159	WAGR made METAL BOXES	64	A	A	D	R
8197	3-ft 3-ROLL BENDING ROLLS	57	B	A	W	R

Group TA TARPAULIN SHOP

SUMMARY

When Midland Workshops was established, the manufacture and repair of canvas tarpaulins for covering goods in transit was a major task, and warranted construction of a special Tarpaulin Shop, Building No.33. This is a tall brick building, high enough to accommodate two storeys, but having just one floor at ground level. The very high roof allowed tarpaulins to be hung up from ropes and hooks from the roof trusses, presumably to allow washed or treated canvas to dry. The walls had normal windows at ground level, but banks of ventilation louvres at the upper level.

Tarpaulins had to be cut out and sewn around the edges, and fitted with eyelets and/or ropes. It is not clear whether this was done originally by hand or by machine, as no tarpaulin-sewing or eyelet machines are mentioned in the early machinery lists. However, the annual reports routinely noted the work done by the Tarpaulin Shop, typically running into 2000 or 3000 new tarpaulins made and 4000 or 5000 repaired each year, and it seems very likely that sewing machines and eyelet machines would have been used early on.

The Tarpaulin Shop was relocated from Building 33 to Building 66 in 1942, and was very busy at that time. However, when seen in 1993 the (New) Tarpaulin Shop looked as though tarpaulin work had ceased some years earlier. The Shop had several modern heavy-duty sewing machines, alongside older-looking sewing tables with wooden roller edges (for easy handling of heavy tarpaulins). There was a table for stretching tarpaulins flat, and a modern steel frame with ropes and pulleys for hanging tarpaulins vertically, like washing on a clothesline (perhaps to dry stencilled lettering). There were a few minor items of tarpaulin-making equipment considered to be of some heritage significance, including an eyelet machine, a small guillotine, and a vyce used in putting cleats and eyes on ropes. There was also a hand-truck (No.8165) for moving old-style pallets, but that is discussed under Group MH.

These remnant Tarpaulin Shop items were assessed as having moderate to high (but not very high) significance. A small collection of Tarpaulin Shop equipment is recommended for conservation for use in a token display of this once-important aspect of Workshops activities, but relocated to some other building where it can be consolidated with other displays. The Old and New Tarpaulin Shops could then be used for other purposes. Some samples of modern vinyl and (if possible) early canvas tarpaulins should also be kept for display.

Group TA **TARPAULIN SHOP**

SIGNIFICANCE

Items related to Tarpaulin Making (Group TA), have some significance for reasons including the following:

* They represent an important but often overlooked aspect of the Workshops activities, making tarpaulins to protect goods in transit in open-top wagons or stored in open goods yards. This was an activity which warranted its own specially designed building in 1904, a new building in 1942, and a mention in every Annual Report of the Railways.

* The Work Order Board (No.8162), with work orders still attached, is a good representative of the simple pre-computer job-control system widely used throughout the Workshops.

RECOMMENDATIONS & CONSERVATION POLICY

* Conserve a small collection of Tarpaulin Shop equipment as recommended in the Inventory, for use in a display of this once-important aspect of Workshops activities. Keep also sample tarpaulin material, ropes, cleats, etc., and some complete tarpaulins for display. Keep sample specification drawings of tarpaulins for display. If possible, keep samples of both modern vinyl and traditional canvas tarpaulins, as well as samples of stencils and/or stencil markings put on the tarpaulins.

* Relocate the collection to some other building where it can be consolidated with other displays.

* Keep the cupboard with Work Order Board (No.8162) complete with work orders, for display either as part of the Tarpaulin Shop, or as part of the Workshops administration system.

Group TA **TARPAULIN SHOP**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
827	Jones Burton HAND OPERATED GUILLOTINE	66	B	A	W	R
1516	"Carr Fastener" EYELETING MACHINE	66	C	B	W	R
1865	SINGER No.2 SEWING MACHINE	66	C	B	W	R
3221	WAGR made BOBBIN WINDER	66	C	B	W	R
8073	WAGR made LEATHER TOOL BAGS	22	B	B	D	O
8161	TARPAULIN TABLE & STRETCHING BARS	66	B	B	D	R
8162	TARPAULIN WORK ORDER BOARD	66	A	A	D	R
8163	WAGR made (Kerosene Can) CHEST OF DRAWERS	66	B	B	D	R
8164	OLD POST VYCE (adapted for rope work)	66	A	A	W	R
8166	SET of DRYING LINES for TARPAULINS	66	C	B	O	
8167	SEWING BENCH with WOODEN ROLLERS	66	B	A	S	R
8246	SINGER (?) BOBBIN WINDER	66	A	A	D	R

Group TR TRACKWORK & PERWAY (Rails, Points, Sleepers, etc.)

SUMMARY

The Track Equipment Shop was almost a separate enclave within the Workshops, in that the output of this Shop was concerned with servicing the permanent way rather than the rolling stock. As seen in 1993, the main task of the Track Shop was to plane (machine) lengths of rail to a taper, and assemble these with cast steel components, to make rail crossings or switching points. These were then sent out for use by perway gangs in construction or repair of the rail network throughout the State.

The Track Equipment Shop used a combination of machine shop, blacksmithing and boilermaking techniques, and this is reflected in the equipment they used. The main items of plant included in the inventory for the Track Shop (Group TR) are two rail planers or long-bed planing machines (Nos.1013 & 2036) which shaved lengths of standard rail to a taper point. Also listed are some templates and gauges (No.8195), several small trackwork aids (Nos.8192, 8193), and a less significant modern hydraulic rail bender (No.2574). The Track Shop also has a slotting machine and a radial drill, but those are standard machine shop tools and are listed under Group MS. The Track Shop also has some blacksmith hand tools, listed under Group BL.

Group TR TRACKWORK & PERWAY (Rails, Points, Sleepers, etc.)

SIGNIFICANCE

Items related to Track Work and Permanent Way Maintenance (Group TR), are significant for reasons including the following:

* The gauges, templates and sample rail cross-sections (No. 8195) are significant in representing and demonstrating the surprisingly large variety of rail sections used in the Westrail network.

* The long-bed rail planing machines (Nos. 1013 & 2036) are significant as rare special-purpose machine tools devoted to making perway components, one of which (No. 1013) is still in use after a working life of over 65 years. Both also have significant and technically interesting original electric drives and electric control cabinets.

* The small perway aids (Nos. 8192 and 8193) are probably significant as relics of past perway construction or maintenance methods.

RECOMMENDATIONS & CONSERVATION POLICY

* It is recommended that the specialised rail planers (including electrical gear and cutting tools), the slotting machine and the minor aids be conserved for working display of the Track Equipment Shop activities. Consider also keeping the modern non-heritage rail bender and cut-off saw, partly to round out the display group, but primarily to enable the group to continue undertaking manufacture of points and crossings on a commercial basis.

* Keep templates, miscellaneous hand tools, samples of raw materials and samples of finished points and crossings, for display. (Note that the cast manganese steel components may well also represent the final job of the electric furnaces in the Foundry.)

* Relocate the Track Shop machinery to join the closely related display of machine shop and wheel shop equipment in Block 3. This will consolidate the areas on display, simplify their management, and free the present Track Equipment Shop building for other uses.

Group TR **TRACKWORK & PERWAY**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1013	Redman RAIL PLANER	59	A	A	W	O
1013	Shelves of CUTTING TOOLS for Redman PLANER	59	A	A	W	O
1013	LDC AC-DC ROTARY CONVERTER & DC MOTOR	59	A	A	W	O
1013	L.D.C. CONTROL CABINET for Redman PLANER	59	A	A	W	O
2036	Stirk "Hiloplane" RAIL PLANER	59	B	B	W	O
2036	Brookhurst CONTROL CABINET for Stirk PLANER	59	B	B	W	O
2574	Finlay HYDRAULIC RAIL BENDING PRESS	59	C	B	C	O
8192	MANUAL SCREW-TYPE BENDER or CLAMP	59	B	B	D	O
8193	UNIDENTIFIED TRACK-WORK AIDS	59			H	O
8194	CAST COMPONENTS of RAIL CROSSINGS	59	B	B	S	O
8195	TEMPLATES & GAUGES for Trackwork Components	59	A	A	W	O

Group UP UPHOLSTERY

SUMMARY

The Upholstery Shop, aka Trimming Shop, was responsible for making and repairing seats and cushions and similar trimmings in carriages. Originally they worked with leather or cloth coverings and horsehair stuffing, and their equipment included a horsehair teasing machine (now gone) for pulling apart compacted horsehair and giving it a soft resilient consistency. (An equivalent horsehair teasing machine still exists at Newport, Victoria.) The Midland Upholstery Shop was then located in or near the present Test House (Building 54), and the horsehair machine in a separate small shed nearby.

As seen in 1993, the Upholstery Shop (now called Trimming Shop) was located in the southern bay of the new Paint Shop (Building 64). It dealt with foam plastic cushioning material, and vinyl-coated cloth covers. The equipment consisted mainly of some industrial sewing machines of moderate to considerable age, and high to very high significance, and large quantities of plastic foam and solvent-based glues for use with the foam and vinyl.

Group UP UPHOLSTERY

SIGNIFICANCE

Items related to Upholstery Work (Group UP), are significant for reasons including the following:

* The Group represents what was an important but often overlooked trade of the Railway Workshops, concerned mainly with carriage construction and maintenance, and relevant to any member of the public who has sat on a carriage seat.

* Several of the Upholstery Group sewing machines (Nos.1017, 1461, 3185) are or appear to be quite old machines of individual significance. They are also representative of the many other similar sewing machines used in the Shop in the past, and reminiscent of the many people who would have been employed to operate the sewing machines.

RECOMMENDATIONS & CONSERVATION POLICY

* The several sewing machines and an eyelet machine listed in the Inventory should be conserved, together with their associated tables and chairs, motors and controls. Samples of materials and thread, and some finished cushions should also be kept. These should be displayed as representing this aspect of the Workshops. However, they should be relocated to some other building where they can be consolidated with other Workshop Museum displays.

* It is recommended that only a small amount (if any) of the foam cushioning, and none of the associated solvent-based glues, should be kept with the display, due to the fire risk associated with those materials.

* If possible, samples of earlier upholstery work using leather and horsehair should be obtained and displayed. Such materials could be used for restoration of upholstery in historic railway carriages, for ARHS.

Group UP **UPHOLSTERY**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1017	Singer SEWING MACHINE	64	A	A	W	R
1461	Singer SEWING MACHINE	64	A	A	W	R
3094	WAGR made EYELETING MACHINE	64	C	B	W	R
3185	Singer SEWING MACHINE	64	A	A	W	R

Group UT UTILITIES

SUMMARY

Group UT - Utilities - is concerned with the supply of electric power, compressed air, low-pressure water, drainage, etc. The services were mostly centred on, but not confined to, the former Powerhouse (Building 22) and reticulated around the site. The Utilities which are represented by artefacts in the Inventory are discussed under the headings:

ELECTRICITY SUPPLY, & STEAM

COMPRESSED AIR

LOW PRESSURE AIR

HIGH PRESSURE WATER - See Group HY.

FIRE SPRINKLERS

CYCLONES

SUMMARY - ELECTRICITY SUPPLY, & STEAM

When Midland Workshops was established, it was decided to power the machinery not by steam engines but by electric motors, using electricity generated on site in the Powerhouse. Whereas most of the Workshops buildings and equipment were designed or specified by the P.W.D. of W.A., the Powerhouse buildings and equipment were designed in Britain. Unfortunately, little detail of the Powerhouse generating equipment was seen during this study. It is known that there were four 200 kw generators and two 60 kw generators, but their voltage and frequency were not identified. The generators were arranged along the west side of the Engine Room (Powerhouse), with steam, supplied from the adjacent Boiler House, and condensed in condensors set into the floor at the north and south ends of the Engine Room. Condensor water was circulated through the "hot and cold wells" or in-ground concrete tanks outside the southern end of the Powerhouse. (See Item 8252, still in situ in 1993).

Power output was monitored and controlled by meters and a switchboard at the mezzanine floor level on the east side of the Engine Room. Power was then distributed to the Shops via cables running through the main service conduit (a tunnel north-south, near the west end of Blocks 1, 2 & 3), and through branch tunnels running east-west under the various buildings. Within the buildings, power was distributed to lights, lineshaft motors and overhead cranes by wires mounted individually on ceramic insulators and/or grooved wooden blocks (some of which still exist - Item 8186). The 1904 Workshops had both incandescent and arc lighting, but no evidence of the c1904 lighting system was seen in 1993. (See Plans 712, 1146, 1235, 2664, 2665, 10190, held in C.M.E. Office Strong Room.)

Group UT **UTILITIES**

SUMMARY - ELECTRICITY SUPPLY, & STEAM (Continued)

Steam to drive the generators was produced in a bank of boilers in the Boiler House (Building 23) attached to the west side of the Powerhouse. This had a peculiar arrangement of three Lancashire type (horizontal cylindrical) boilers on the eastern side of the Boiler House, and seven water-tube type Babcock & Wilcox boilers along the western side. Coal was delivered by rail wagon into an in-ground hopper at the northern end of the Boiler House, then carried by a bucket conveyor-cum-elevator to steel coal bunkers mounted near the roof of the Boiler House (No.8155). From there the coal was gradually fed by chutes to the various boilers. Ash from the boilers was collected in a pit along the centre of the Boilerhouse floor, and from there the same bucket elevator/conveyor took the ash to an external hopper above the northern doorway, for dumping into rail wagons and eventual disposal (probably in the yard at the south-east of the site).

Flue gases from the boilers were collected in a horizontal floor-level brick flue running along the east, south and west walls of the Boiler House, and then conducted up a tall steel chimney at the north-west corner of the building. The western leg of the flue had two alternative paths, controlled by baffle doors, which diverted the hot gases through economisers (to extract heat from the gas and warm the incoming water), or bypassed the economisers to allow them to be serviced.

The general arrangement of the Powerhouse and Boiler House buildings, the generators and boilers, and the ash & coal handling plant, is shown in archival PWD Plans 22019, Drawing No.8, Sheets 1 to 9, which are also numbered as CE Plans 70000/80 Sheets 31 to 39. These are undated "As Constructed" drawings, estimated as c1904.

In 1917/18 Midland Workshops began receiving high-voltage power from East Perth Power Station, which was stepped down to low voltage for supply to motors etc., via transformers in the substation annexe at the east side of the Powerhouse. The Workshops' own generators were removed and sold c1918, leaving no trace other than a few steam pipe support brackets, and possibly sub-floor structures (Items 8069 and 8257). The mezzanine floor was kept, but the switchboard was removed, leaving just a few electric meters now lying loose in a store near the top of the substation (Item 8084). The East Perth supply was at 40 Hz frequency, which did not match the original Midland frequency. This made existing motors run at a different speed. Consequently, some machines were fitted with new 40 Hz motors and some existing motors had new pulleys fitted to compensate for the change in speed.

The Boiler House boilers were kept operating for a few more years, mainly to supply steam to the Blacksmiths' steam hammers, but in 1922/23 the boilers were shut down and removed from the Boilerhouse. Some of the boilers were re-erected at the eastern end of the Blacksmiths Shop to supply the steam hammers, and to consume sawdust, replacing earlier boiler(s) in the same location. The ex-Boiler House boilers operated there for many more years.

Group UT **UTILITIES**

SUMMARY - ELECTRICITY SUPPLY, & STEAM (Continued)

The coal and ash handling plant, most of the horizontal brick flue, and the tall steel chimney, were all removed from the Boiler House, and the building was converted into a Coppersmiths Shop (the third one). The remnant brick chamber for the economisers was converted to the Coppersmiths Store, and the brick base for the steel chimney became a small workshop and welding room, opening off the main Coppersmiths shop.

The remaining evidence of the Boiler House equipment and operation is mainly in the structure and layout of the building, including the steel frame which supported the coal bunkers, the chimney base, the economiser chamber, and the coal/ash conveyor opening in the north wall. It is possible that the original sub-floor structures for coal handling and ash collection still survive.

During 1953-56 the Workshops had to accomodate yet another frequency change, as Perth adopted the Australian standard 50 Hz supply. Again some motor pulleys were changed to compensate, but mostly the old 40 Hz motors were removed (with associated lineshafting and flat belt drives), and new 50 Hz motors were fitted to individual machines. There are now very few 40 Hz motors still in use.

SUMMARY - COMPRESSED AIR

The 1904 Powerhouse had an air compressor and vertical cylindrical air receiver (air tank) in the north east corner of the Engine Room, for reticulation to various Shops as shown in Plan 1301 (c1904). In 1923/24, after the generators were removed, two electric-drive "Sentinel" compressors (Items 583, 584) were installed at the south-west corner of the room, and apparently the 1904 air receiver (Item 8086) was relocated near them. In 1937 a larger Sentinel air compressor was installed at the north-east corner of the room, replacing the 1904 compressor. During World War Two a huge Crossley-Reavell air compressor with oil engine (Item 1197) was installed at the SE corner of the room, presumably to overcome power shortages. The Sentinel and Crossley-Reavell compressors and the riveted air receiver are all still in place, and constitute an impressive collection of air compressors spanning 70 years of service.

Compressed air was used to operate various small tools such as chipping hammers and riveting guns, and to drive pistons which squeezed sand into moulds, opened or closed heavy furnace doors, etc.. It was probably used (somewhat dangerously) as a jet to blow dirt off castings etc.. In later years, compressed air was used to drive several large blacksmiths' hammers, which had originally been powered by steam.

Group UT **UTILITIES**

SUMMARY - LOW PRESSURE AIR

The 1904 Powerhouse had a pair of 3-throw Tannet Walker low-pressure blowers, supplying combustion air to Foundry cupolas, and possibly to Blacksmiths' fires. (See blowing pipe layouts in Plans No.1230 & 1286 (both of 1904). One Tannet Walker survives (Item 589), but relocated to the north-west corner of the Engine Room. (The plant card says it was installed in 1913, but this is unlikely.) It is a curiously old-fashioned design, even for 1904 and is an extremely rare machine.

SUMMARY - HIGH PRESSURE WATER - See Group HY.

SUMMARY - FIRE SPRINKLERS

The 1904 Power House Engine Room held a pair of Fire Pumps, probably fed from the elevated 50,000 gallon cast-iron tank on top of the brick water tower (Building 16) now used as a pattern store. The pumps have been removed, as have the sides of the water tank (leaving the base on top of Building 16). The pumps supplied water to a network of sprinkler pipes in the various Shops.

The sprinkler system was a fairly early example of its type. Major components (mostly supplied by Mather & Platt and/or Grinnell) are still in situ, and many still in use, although the original water-powered alarm bells are now disconnected (Item 8011). Associated pressure gauge boards refer to the original Munwaring Weir water supply. These components should be conserved as representing the state-of-the-art fire sprinkler service of their day.

SUMMARY - CYCLONES

Three "Cyclones" outside the south wall of Block 1 provided a utility service for the collection and disposal of sawdust and shavings from the Wood Mill. The first Cyclone was installed after the 1912 additions to Block 1. Later, two more Cyclones were added to cope with increasing quantities of waste. The sawdust was probably treated as waste in the early years, but after the steam boilers were moved to the east end of the Blacksmith Shop in c1923, a duct or conveyor was built across the roof of Block 2 to carry the sawdust over to fire the boilers. Three Cyclones (No.8090) are still in situ next to the Wood Mill, but they are probably not the original machines.

Group UT UTILITIES

SIGNIFICANCE

Items related to Utilities (Group UT), are of various levels of significance for reasons including the following:

* Physical evidence of the original ELECTRICITY SUPPLY, & STEAM GENERATION exists mainly in the Powerhouse and Boiler House buildings themselves, and possibly in their sub-floor structure (No.8257). Most artefacts provide only sparse evidence of limited significance, although they do help to verify the information in PWD drawings. The few artefacts of higher significance are the "hot and cold wells" for condensor water (Item 8252), the gauge panel (No.8069), and the remnant electrical instruments (No.8084) which could yield technical information about the power supply system (and other services).

* Artefacts of the COMPRESSED AIR supply system include three operational Sentinel air compressors Nos.583, 584 and 1009, and the enormous Crossley-Reavell compressor No.1197, which together form a most significant group representing air compressor technology from 1920s to 1940s. The group also includes several riveted air receivers of various styles and ages, including one (No.8086) which is probably part of the original 1904 air supply system. They also form part of the significant and visually impressive current Powerhouse plant layout.

* The Powerhouse holds one Tannet & Walker LOW PRESSURE AIR blower (No.589) which supplied air to foundry furnaces, and which was probably part of the 1904 Powerhouse set-up, but since relocated. It is of very high significance as probably the only machine surviving from the 1904 Powerhouse, and as a machine representative of 19th century design style.

* It is difficult to tell how much of the existing FIRE SPRINKLER SYSTEM is original, and how much is newer. The disconnected Mather & Platt gauges labelled "Mundaring Weir", and the disconnected water-operated alarm bells (No.8011) are almost certainly original, and so are of high significance as early examples of fire sprinkler services, and as possible sources of technical information about such early systems.

* Of three steel "CYCLONES" (No.8090) for collection of sawdust from the Wood Mill, two appear to date from c1927, and the third appears to be a later replacement of the c1912 original. These are of high significance as examples of an industrial waste collection system which is still operating successfully after at least 60 years use, and which closely follows the design of a system introduced 90 years ago.

Group UT **UTILITIES**

RECOMMENDATIONS & CONSERVATION POLICY

* Surviving artefacts forming physical evidence of the original ELECTRICITY SUPPLY, & STEAM GENERATION, as listed in the Inventory, should be conserved in situ, and used to help interpret the original function of the Powerhouse and Boiler House. The Boilerhouse coal bunker structure should be left in situ, and visible, and the coal conveyor opening made visible, perhaps by installing a matching window instead of corrugated iron cover. The bunker structure could possibly be used to support a new mezzanine floor. The remnant electrical instruments (No.8084) and the sub-floor structure (No.8257, if existing) should be studied to try to gain further information about the original power generation system. Appropriate electrical instruments might be used in displays of the original power generation system on the mezzanine floor of the Powerhouse.

* The three Sentinel air compressors Nos.583, 584 and 1009, the enormous Crossley-Reavell compressor No.1197, and their associated riveted air receivers, should be conserved as an integrated system. Those elements within the Powerhouse should be retained in situ, and preferably in working order, as part of the Powerhouse suite of machines. The external air receivers could be relocated if necessary.

* The currently operating Sentinel compressor (No.1009) should be kept operational, but might be too noisy to run if the Powerhouse is routinely open to visitors (as in a static museum site). It may become necessary to relocate the big Sentinel to supply compressed air for the Working Museum. If so, its site should be carefully chosen for protection of the machine and ease of demonstration of its operation.

* The Tannet & Walker blower (No.589) should be conserved in situ, and maintained in working order if possible. Its early history should be researched, to see whether it is one of the two original 1904 blowers, as suspected. If needed, a modern blower could be installed elsewhere.

* At least some of the remaining original Mather & Platt fire sprinkler gauges, gauge boards and alarm bells (No.8011), should be conserved in situ for interpretative display of the fire sprinkler system technology, and the water supply history. If necessary, other similar examples of fire sprinkler bells and/or gauges and boards could be removed and stored for future study or as spares.

* At least one of the two c1927 "Cyclones" (No.8090) should be conserved in working order for collection of sawdust from the Wood Mill, which itself is to be kept operating at least for demonstration purposes. The third (eastern) cyclone should be investigated to determine its age, and a more definite decision made in the light of that information.

Group UT **UTILITIES**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
583	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
584	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
589	Tannet Walker LOW-PRESSURE BLOWER	22	A	A	W	Y
1009	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
1009	B.T.H. CONTROL PANEL for Sentinel COMPRESSOR	22	A	A	W	Y
1197	Crossley Reavell AIR COMPRESSOR	22	A	A	W	Y
8011	Mather & Platt / Grinell SPRINKLER SYSTEM	47	B	A	D	P
8033	SUMP PUMP, PNEUMATICALLY POWERED	52	B	B	D	P
8068	RIVETED COMPRESSED AIR TANK	22	B	B	W	O
8069	CAST-IRON STEAM-PIPE BRACKET	23	B		D	Y
8069	CAST-IRON STEAM-PIPE BRACKETS	22	B		D	Y
8069	CAST-IRON STEAM-PIPE BRACKETS	46	B		D	Y
8076	INSTRUCTIONS for "Sentinel" COMPRESSOR	22	A	A	D	Y
8077	SPARE PRESSURE RELIEF (SAFETY) VALVE	22	A	A	D	R
8086	TALL RIVETED AIR RECEIVER	22	A	A	W	Y
8090	SAWDUST COLLECTION "CYCLONES"	47	B	B	W	O
8188	Pair of RIVETED COMPRESSED AIR RECEIVERS	90	B	A	W	O
8250	PANEL for various PRESSURE GAUGES	22	A	A	D	Y
8252	HOT & COLD WELLS (CIRCULATING TANK)	90	B	B	P	Y

Groups WO & WP WOODWORK (Wood Mill, Saw Doctor & Pattern Making)

The Woodworking Group has been divided into two sub-groups, identified as:

Group WO - WOOD MILL & SAW DOCTOR

Group WP - PATTERNS & PATTERNMAKING

Group WO WOOD MILL and SAW DOCTOR

SUMMARY

When Midland Workshops was established, carriages were made predominantly of wood, and the Wood Mill was kept very busy cutting rough timber down to usable size, dressing timber to give smooth flat surfaces or profiled shapes, making wooden components to the correct dimensions, carefully preparing matching joints so that components would fit together properly with other components, and sanding the components to a smooth surface ready for painting or varnishing. These pre-made components were then sent to the adjacent Car & Wagon Shop for assembly into a carriage, and later to the Paint Shop for finishing.

Wagons were also made predominantly of wood then, but naturally the wooden wagon components made in the Wood Mill were more robust and less finely detailed than the carriage components. The Wood Mill also made a wide variety of other wooden items, ranging from heavy timbers for bridgework, to fine building joinery and furniture etc, for Railways use.

The Wood Mill was set up in 1904 with an extensive array of woodworking machines from the most reputable manufacturers, such as Robinson of Rochdale (UK), and J.A. Fay of USA. Some of the machines were bought between 1895 and 1902, and were used at Fremantle Workshops before Midland was built. Due to the good quality of the machines, and the unchanged basic nature of wood machining operations, a large number of the c1904 machines are still in the Midland Wood Mill and in working order after 90 years or more of faithful service.

These early machines were originally driven by long flat belts from overhead lineshafts. At about the 1950s the lineshafts were removed, and each machine had an individual electric motor bolted-on, fortunately with little damage to the integrity and significance of the original machines.

Group WO **WOOD MILL and SAW DOCTOR**

SUMMARY (Continued)

Further machines were added, particularly in the 1920s, 1940s and 1950s, extending the capabilities of the Wood Mill. These later machines are of moderate to high significance individually, but together with the earlier machines they constitute an unusually comprehensive group representing the evolution of woodworking machinery in the first half of this century. This group of woodworking machines is of very high significance, and should be conserved as a group, including associated cutting tools, etc.

New woodworking machines continued to be installed up to 1960s and 1970s. These later machines are of little heritage significance (as yet), but their conservation with the other Wood Mill machines should be considered, as extending the scope and interest of a future working museum display, and as assisting the ability of the collection to attract commercial work or to undertake training of apprentices.

The Wood Mill occupies all of Bay 4, Block 1. The woodworking machines are located mainly in the western half of Bay 4. The eastern half of Bay 4 holds a few machines, but is mainly occupied by wooden benches used for manual woodworking operations. These benches did not appear to be of particular significance individually, but a few sample benches should be kept to complement the woodworking machinery.

There were several trolleys used for moving heavy timber in or out of specific woodworking machines, and numerous light wooden pallets (like stretchers), used for moving large numbers of small wooden components between processes. These should be conserved as significant artefacts in their own right, and as complementing the major machines. (There are also trolley rails, turntables and four-wheel trolleys serving the Wood Mill, as part of the trolley network which served all the main Workshops buildings, but these are covered under Group MH, Materials Handling.)

Carriages and wagons are now made mostly of steel or aluminium, and so the workload and staffing of the Wood Mill has greatly diminished. However, most of the Wood Mill equipment has been retained, leaving it as a very highly significant collection of woodworking machinery spanning nearly 100 years, and possibly the best and most comprehensive collection of industrial woodworking machinery in Australia. The most significant machines should be conserved as an integrated group, together with associated cutting blades, etc., for a working museum of industrial woodworking. The less significant should be considered for conservation to complement the display of more significant ones, and to assist in gaining income from commercial work.

Group WO **WOOD MILL and SAW DOCTOR**

SUMMARY (Continued)

Associated with the Wood Mill is an extensive UNDERFLOOR DUCTING SYSTEM and a set of fans for extracting sawdust from each machine. The dust was blown to several "cyclones" outside the south wall of the Wood Mill, where the dust was collected for burning in boilers or incinerators. The system was installed in c1912, upgraded in the late 1920s, including installation of new Sturtevant fans, and that upgraded system is still virtually intact today.

Closely associated with the Wood Mill, and crucial to its efficient operation, was an enclosed SAW DOCTOR area, with a number of small machines used for sharpening and setting hand saws, band saws and circular saw blades, and sharpening the other various cutting and shaping bits used by the woodworking machines. The Saw Doctor sometimes filed saw teeth by hand, but more often used machines to grind or file the cutting teeth on the various saws and bits. He also used a small butt-welding machine to join long lengths of bandsaw blade material into a continuous loop. The Saw Doctor used metalworking skills which combined elements of both Fitting and Toolmaking trades, but his work was so closely associated with the Wood Mill that his equipment is included in the inventory under Group WO.

The Saw Doctor machines are not very old, mostly from 1950s or later, but they are significant as a comprehensive group and especially as an adjunct to the overall Wood Mill Group. They would also make an interesting interpretative display, and may be able to earn income from commercial or domestic saw sharpening and setting.

Group WP PATTERNS and PATTERNMAKING

SUMMARY

A pattern is a precise model of an object to be cast in a foundry. Patterns are used to make the correct shape cavity in sand moulds, into which the molten metal is poured. The Pattern Shop (Building 17) was one of the original 1904 group of buildings, making patterns for use in the Workshops' own Foundry, or for outside commercial foundries casting railway components. The Pattern Shop was still use until late 1993.

Patterns are usually made of wood, and patternmakers are the elite of woodwork craftsmen, equivalent to toolmakers in the metal trades. To achieve the necessary precision, patternmakers use special lathes and milling machines similar in principle to metalworking lathes and mills, but adapted to suit the different workpiece dimensions and weights, and the different cutting speeds and cutting forces, involved with woodwork.

Although most pattern making at Midland involved wood-working skills and equipment, some patterns were made of metal (eg. aluminium), and so the patternmakers had to also have the skills and equipment to work in those materials.

The Midland Pattern Shop has an old wood milling machine (Item 436) and a specialised wood lathe (Item 1961) of very high individual significance, and a number of other woodworking lathes, saws etc., of high significance. The wood milling machine was installed in 1914. Most of the other machines date from the 1950s, but are similar in style to machines of 10 or 20 years earlier. The Patternmaking Group of woodworking machines has very high significance as a comprehensive group representing a well-equipped patternmaking shop of the 1950s or earlier.

There are also several recent metalworking machines used to make aluminium patterns, which give longer life when making very large numbers of moulds. These machines are of lesser heritage significance, and are listed with the general machine shop metalworking tools, Group MS.

The patterns and pattern records are themselves of very high significance. The pattern records should be taken into archival care, and the more significant patterns should be conserved. In the interim, all patterns should be kept pending individual assessment of their ongoing usefulness, their possible use for restoration of historic rolling stock, their inherent significance either as artefacts or as representing important castings made in the past, and their value as exhibits to help interpret the role of the Pattern Shop equipment.

The Pattern Shop has been located in Building No.17 since 1904. Ideally the Pattern Shop equipment should be kept in situ. However, if it is necessary to clear Building 17 for some other adaptive re-use, it would be preferable for the Pattern Shop equipment to be relocated as a whole group, eg. to the Wood Mill, Block 1, rather than be lost.

Groups WO & WP WOODWORK (Wood Mill, Saw Doctor & Pattern Making)

SIGNIFICANCE

Items related to The Wood Mill, the Saw Doctor, or to Patterns and Patternmaking (Groups WO and WP), are significant for reasons including the following:

* The Wood Mill's collection of industrial woodworking machines is of outstanding significance, covering a comprehensive variety of machines, and ranging from c1895 to the 1950s and later. A large number of the machines have been in use since the 1904 establishment of the Midland Workshops, and several are even older, having been transferred from Fremantle.

* Many of the woodworking machines are individually of very high significance, being high quality machines made by the most reputable manufacturers, still in working order after 90 years or more of service.

* The Wood Mill has probably the best, most comprehensive, most significant collection of historical industrial woodworking machinery in Australia.

* The Saw Doctor machines are not very old, mostly from 1950s or later, but they are significant as a comprehensive group which is a good representative of its type, and as providing a service essential for the continued operation of the Wood Mill Group.

* The extensive c1920s sawdust extraction system, with underfloor ducting, fans, and "cyclones" outside the wall of the Wood Mill, where dust was collected for burning in boilers or incinerators, is significant as a successful industrial waste removal system which has been operating for about 65 years, and is based on a system installed 90 years ago. It makes Wood Mill operation much cleaner and safer than it would otherwise be.

* The Pattern Shop woodworking machines, benches and hand tools comprise a highly significant group representing a well-appointed Patternmaking Shop of the 1950s, with a few older machines dating back as far as 1914. It includes several top-quality patternmaking machines of high individual significance, including Wood Mill No.436, and specialised Wood Lathes Nos.1959, 1960 and 1961. The Pattern Shop's metalworking machines are more modern and of lesser heritage significance.

* The Midland collection of Patterns is of very high group significance, representing the work of the Pattern Shop and Foundry over 90 years, and including many individual patterns of high or very high significance, such as those used to make castings for earlier locomotives and carriages, and still capable of making similar castings for restoration or replication of historic rolling stock. The physical patterns are complemented by pattern record cards and pattern drawings held in the Pattern Shop, which are themselves of very high significance as a record of past Workshop and Pattern Shop activities, and can aid in identifying the physical patterns.

Groups WO & WP WOODWORK (Wood Mill, Saw Doctor & Pattern Making)

RECOMMENDATIONS & CONSERVATION POLICY

* The older and more historically significant of the Midland Wood Mill woodworking machines, as listed in the Inventory, should be conserved as a group, including associated cutting tools, etc. The group should be conserved predominantly in situ, although some individual machinews could be relocated within the Wood Mill area. The machines should be conserved primarily as important heritage items, for display in a working museum context, but could still undertake contract commercial woodworking or be used for technical training.

* Newer woodworking machines installed in the 1960s and 1970s should be considered for conservation with the other Wood Mill machines, as extending the scope and interest of a future working museum display, and as assisting the ability of the group to attract commercial work or to undertake training of apprentices.

* Sample workbenches and some manual woodwork tools should be kept to complement the woodworking machinery. The several large trolleys used for moving heavy timber around, and the numerous light wooden pallets (like stretchers), used for moving large numbers of small wooden components between processes, should be conserved as significant artefacts in their own right, and to help operate and interpret the major machines.

* The underfloor sawdust extraction system and associated fans, and at least one of the external c1927 "cyclones", should be kept in situ and operational, to conserve a representative part of the extraction system and to serve the retained woodworking machines.

* The Saw Doctor equipment should be conserved in its entirety as a working unit, complete with benches, stools, and printed saw setting guides. If necessary, the whole Saw Doctor sub-group could be relocated to another area, but it should remain together as a unit. The Saw Doctor unit should remain associated with and servicing the Wood Mill Group, but should also be able to undertake commercial saw sharpening for industrial or domestic customers.

* The woodworking equipment of the Pattern Shop (including associated cutting bits and other accessories) should be conserved as a working group, for a working museum display of traditional wooden patternmaking, and possibly to continue as a commercial patternmaking shop, or as a centre for training in the patternmaking trade. The metalworking equipment for making metal patterns could be retained at the Pattern Shop if it is likely to be used for commercial, training or demonstration purposes. However, if the metal patternmaking equipment is unlikely to be used for patternmaking in future, then that equipment may as well be consolidated with the Machine Shop's metalworking tools.

Groups WO & WP WOODWORK (Wood Mill, Saw Doctor & Pattern Making)

RECOMMENDATIONS & CONSERVATION POLICY (Continued)

* Prohibit ad hoc scrapping or removal of patterns. Select representative or particularly important patterns for conservation in accordance with a specially prepared PATTERNMAKING CONSERVATION PLAN. In broad principle, the criteria for selection of patterns for conservation should include:

  1. Patterns which may be needed to make replacement parts for machinery and rolling stock currently in service.

  2. Patterns which could be used to make replacement parts for vintage locomotives and other vintage rolling stock and for Midland Workshops machinery being restored for interpretative display.

  3. Patterns representing important Midland Workshops machinery made only at and for Midland Workshops.

  4. Patterns representing particularly important locomotives or rolling stock made at Midland Workshops.

  5. Patterns representing important locomotive or rolling stock developments. (eg. the first of its type made in W.A.)

  6. Patterns which could be used in interpretative displays of Foundry work and Pattern Making.

  7. Patterns representing excellence of, or technical advances in patternmaking or foundrywork.

  8. Patterns having aesthetic or collector interest.

* Conserve the entire collection of Pattern Record Cards as important archival material, and relocate them to a secure archival store. If necessary, keep duplicate copies of the cards in the Pattern Shop. Review the collection of pattern drawings in the Pattern Shop, and conserve any which are not available from a central drawing archive, or which would assist an interpretative display of patternmaking.

* Preferably keep the entire Pattern Shop equipment collection in working order, and in situ. However, if necessary the Pattern Shop equipment could be relocated and re-established in another building on site, provided the whole Pattern Shop is kept together as an operating unit, and provided the machines are all set up and recommissioned in their new location, and are not simply stored in another building in inoperable condition.

Group WO **WOOD MILL and SAW DOCTOR**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
307	Robinson of Rochdale PEDESTAL GRINDER	47	A	A	W	P
323	Robinson of Rochdale CIRCULAR SAW	47	A	A	W	P
325	J.A. Fay TENONING MACHINE	47	A	A	W	P
327	J.A. Fay 4-SPINDLE BORING MACHINE	47	A	A	W	P
327	RAIL TROLLEYS for J.A. Fay 4-Spindle BORER	47	A	A	W	P
327	CUPBOARD of DRILL BITS for J.A. Fay BORER	47	A	A	W	P
329	J.A. Fay COLUMN FRET SAW (or JIGSAW)	47	A	A	W	P
343	"Stuart Bell" MOTORISED BAND-SAW FILER	47	A	A	W	P
352	J.A. Fay & Egan DISC / SPINDLE SANDER	47	A	A	W	P
1015	Robinson of Rochdale 4-SIDE PLANER / MOULDER	47	A	A	W	P
1015	Robinson PLANER / MOULDER CUTTERS	47	A	A	W	P
1019	Sturtevant CENTRIFUGAL DRIVE FAN & MOTOR	47	A	A	W	P
1019	Sturtevant FAN CUPBOARD	47	B	A	W	Y
1021	Robinson of Rochdale CUTTER GRINDER	47	A	A	W	P
1022	Sturtevant CENTRIFUGAL DRIVE FAN & MOTOR	47	A	A	W	P
1062	Robinson of Rochdale PLANER & THICKNESSER	47	A	A	W	P
1141	"Remo" or "Goodall" PLANER & SURFACER	47	B	A	W	P
1161	Wadkin SAW FILING & SETTING MACHINE	47	A	A	W	P
1169	Wadkin WOOD LATHE	47	B	A	W	P
1216	Macson 2-SPINDLE MOULDER & SHAPER	47	B	A	W	P
1936	WAGR made 8-HEAD DRILLING MACHINE	47	B	B	W	P
1965	Sturtevant DUST EXTRACTION FAN	47	A	A	W	P
2035	White "Faskut" POWER FEED CIRCULAR SAW	47	B	B	W	P
2272	BUTT WELDER for BAND-SAW BLADES	47	B	A	W	P

Group WO **WOOD MILL and SAW DOCTOR**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2277	Wadkin TENONING MACHINE	47	C	B	C	O
2278	Wadkin 2-spindle MOULDING & SHAPING MACHINE	47	B	B	C	O
2278	Wadkin 2-spindle MOULDER, BITS & TOOLS	47	B	B	C	O
2279	Wadkin WOODMILL	47	B	B	C	O
2280	Wadkin BANDSAW	47	B	B	C	O
2282	Wadkin SURFACE GRINDER	47	B	A	W	P
2283	Wadkin TOOL & CUTTER GRINDER	47	B	A	W	P
2323	Pickles-Ransome HORIZONTAL MORTICING M/C	47	B	A	W	P
2323	Pickles-Ransome MORTICING MACHINE SPACERS	47	B	A	W	P
2323	Pickles-Ransome MORTICING MACHINE DRILLS	47	B	A	W	P
2324	White VERTICAL MORTICING MACHINE	47	B	A	W	P
2333	Robinson of Rochdale PLANER	47	B	B	C	O
2334	Gill Bros. ROUNDING or DOWELLING MACHINE	47	B	A	W	P
2343	Pickles-Ransome 4-SIDE PLANER / MOULDER	47	B	B	C	O
2343	Pickles-Ransome PLANER/MOULDER CUTTERS	47	B	B	C	O
2344	Hebco DUAL WHEEL PEDESTAL GRINDER	47	C	C	W	P
2358	White 5-WHEEL GRINDER for TOOL SHARPENING	47	B	A	W	P
2362	Pickles TENON MACHINE	47	C	C	C	O
2364	Stenner CIRCULAR SAW	47	C	C	C	O
2791	Loroch SAW SETTING & SHARPENING MACHINE	47	C	A	W	P
3069	Lotze GULLETING MACHINE	47	C	A	W	P
3095	S.C.M. PLYWOOD SAW	47	C	C	C	O
3096	Mida DOVETAIL CUTTER	47	C	C	W	P
3097	Saturn TOOL & CUTTER GRINDER	47	C	B	C	O
3454	G.M.F. GRINDER	47	C	B	C	O

Group WO **WOOD MILL and SAW DOCTOR**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
3455	Foley T.C. TIPPED SAW-BLADE SETTER	47	C	B	C	O
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8095	SPECIAL CUPBOARD for WOOD-WORKING TOOLS	47	A	A	S	P
8097	CARPENTER'S CLAMPS	47	A	A	W	P
8098	ADJUSTABLE-HEIGHT SUPPORT-ROLLER	47	A	A	W	P
8099	TYPICAL WOOD MILL WORKBENCH	47	A	A	S	P
8135	Phoenix SAW-TOOTH SETTER	47	A	A	W	P
8136	HAND-OPERATED SAW-TOOTH SETTER	47	A	A	W	P
8137	WOODEN SAW VYCE (SHORT)	47	A	A	W	P
8138	WOODEN SAW VYCE (LONG)	47	A	A	W	P
8139	LONG BALANCE ARM	47	?	?	H	P
8140	Saw Doctor's EQUIPMENT on SMALL WORKBENCH	47	A	A	W	P
8141	SHAPER BLADES in FITTED WOODEN CUPBOARD	47	A	A	W	P
8142	SET of ROLLERS used to hold Band-Saw Blades	47	B	A	W	Y
8142	FLOOR STUDS for Measuring Band-Saw Blades	47	B	A	W	Y
8143	STEEL BLOCK SAW-BLADE STRAIGHTENER	47	A	A	W	P
8149	WOODWORKING POSTERS	47	A	A	D	P
8149	WOODWORKING POSTERS	47	A	A	D	P
8247	SAW-DOCTOR'S LOG BOOK (seen in Cupboard)	47	A	A	A	R

Group WP **PATTERNS AND PATTERNMAKING**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
436	Wadkin WOOD MILL	17	A	A	W	O
436	Wadkin WOOD MILL - CUTTERS & TOOLS	17	A	A	W	O
865	Tauco PLANER / BUZZER	17	B	A	W	O
1080	Macson BAND-SAW	17	B	A	W	O
1959	Pickles WOOD LATHE	17	B	A	W	O
1960	Wadkin WOOD LATHE	17	B	A	W	O
1961	Wadkin HEAVY DUTY (SLIDING GAP-BED) LATHE	17	A	A	W	O
1961	Wadkin HEAVY DUTY WOOD LATHE (Gap-Bed detail	17	A	A	W	O
1976	Thomas White WOODWORKER'S TOOL GRINDER	17	B	A	W	O
8005	PATTERNS STORED in Roof of Sand Shed	15	A	A	W	O
8005	PATTERNS on STEPPED SHELVES on Mezzanine	17	A	A	W	O
8005	STACK of PATTERNS	14	A	A	S	R
8005	STACK of WOODEN PATTERNS	17	B	A	S	R
8005	STACKS of PATTERNS on Shelves	16	A	A	W	O
8036	PATTERNMAKER'S WORKBENCH with VYCE etc.	17	A	A	W	R
8038	PATTERN RECORDS	17	A	A	A	R
8038	PATTERN RECORDS	17	A	A	A	R
8040	HEIGHT MARKER / SCRIBER & SURFACE PLATE	17	B	A	W	R
8041	LETTER & NUMBER PUNCHES	17	B	A	W	R

Group ZZ ITEMS NOT IDENTIFIED

A few items were not identified, and so were listed under arbitrary Group ZZ.

As the function and history of these items was unknown, no assessment of significance was made, and no recommendations other than that they be kept in a safe place pending further investigation.

Anyone who can identify these items is invited to contact the authors.

Group ZZ **ITEMS NOT IDENTIFIED**

SUMMARY OF ITEMS IN GROUP INVENTORY

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8180	Large HEXAGONAL NUTS (unidentified)	59	?	?	H	R
8211	2 CAST-IRON MACHINE TOOL TABLES	90			H	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8082	WORLD WAR 1 HONOUR BOARD (CME Branch)	1	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (Stores Branch)	1	A	A	D	O
8234	ARCHIVAL DRAWINGS AND OTHER RECORDS	1	A	A	A	R
8234	ARCHIVAL DRAWINGS	1	A	A	A	R
8170	ABEL FLASH POINT MEASURING INSTRUMENT	2	A	A	D	O
8171	CARBON TRAIN FURNACE & TRANSFORMER	2	B	B	D	O
8172	LABORATORY INSTRUMENTS in Cupboard	2	B	B	D	O
8173	CENTRIFUGE	2	A	A	W	O
8174	VACUUM PUMP	2	A	A	W	O
8175	Dieter-Gibson FOUNDRY CONTROL EQUIPMENT	2	B	A	W	O
8176	SAND-COMPACTOR	2	B	A	W	O
8177	(STEAM) LOCOMOTIVE FUSIBLE PLUG TESTER	2	A	A	D	O
8001	PERSONNEL DOCKETS & BOARDS (MAIN)	5	A	A	D	O
8009	TIMEKEEPER'S CLOCK (aka "BUNDY")	5	A	A	D	R
3108	WAGR made ANNEALING FURNACE in Shed	7	C	-	-	-
8082	WORLD WAR 1 HONOUR BOARD (Auditor Branch)	9	A	A	D	O
8133	STEAM LOCO DIAGRAMMATIC MODEL	9	B		D	R
8134	Julius Sax & Co. MASTER CLOCK	9	B	A	W	O
8144	SEM-CIRCULAR DESKS	9	A		W	R
8235	PLANT ENGINEER'S DRAWINGS	9	A	A	A	R
8236	PLANT CARDS	9	A	A	A	R
8237	ARCHIVAL PHOTOGRAPHS	9	A	A	A	R
496	Hodgson Hartley MOULDING MACHINE	14	A	A	W	O
640	WAGR made MOULDING MACHINE	14	C	B	D	R
641	WAGR made MOULDING MACHINE	14	A	A	S	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
645	WAGR made MOULDING MACHINE	**14**	A	A	S	P
1315	Birlec-Lectromelt 2-ton ELECTRIC FURNACE	**14**	A	A	W	Y
1315	English Elec. CONTROL PANEL for 2-ton Furnace	**14**	A	A	W	Y
1316	Birlec-Lectromelt 3.25-ton ELECTRIC FURNACE	**14**	A	A	W	Y
1316	English El. CONTROL PANEL for 3.25ton Furnace	**14**	A	A	W	Y
1318	WAGR made WHITE-METAL FURNACE (No.58)	**14**	A	A	W	P
1396	WAGR "WAGON BOTTOM" ANNEALING FURNACE	**14**	B	B	W	Y
1447	WAGR made (EAST) CUPOLA BLAST FURNACE	**14**	A	A	W	Y
1637	WAGR made (WEST) CUPOLA BLAST FURNACE	**14**	A	A	W	Y
1637	TAPPING CHANNEL for (WEST) CUPOLA	**14**	A	A	W	Y
1916	WAGR made CORE OVEN with HOT AIR FURNACE	**14**	C	B	O	
2045	SAND CONDITIONING PLANT	**14**	C	B	C	F
2413	WAGR made MOULDING-SAND PAN MILL	**14**	C	B	W	O
3838	POURING LADLES for the Birlec Furnaces	**14**	B	A	W	O
3838	Detail of a Birlec Furnace POURING LADLE	**14**	B	A	W	O
3842	POURING LADLE for the CUPOLAS	**14**	B	A	W	O
8003	WOODEN BRAKE-VAN or GUARD'S VAN	**14**	B	A	D	O
8005	STACK of PATTERNS	**14**	A	A	S	R
8212	SAND TREATMENT MACHINE	**14**	C	B	W	O
8217	RIVETED STEEL LADLE with Fireclay Lining	**14**	A	A	D	R
8218	FOUNDRY MOULDING BOXES	**14**	A	A	D	R
8219	INGOT MOULDS for the Cupolas	**14**	B	A	W	O
8220	Buffalo Forge BAR CUTTER or SHEARS (Model 2)	**14**	A	A	W	P
8221	PREPARED MOULDS with CORES	**14**	B	A	S	P
8221	WOOD MOULDING BOX & PATTERN	**14**	B	A	S	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8222	CHARGING BUCKET, RAILS & WEIGHBRIDGE	**14**	B	A	W	Y
8222	TROLLEY LINE & SCRAP BINS for Charging Bucket	**14**	B	B	Y	W
8223	SMALL PIVOTED POURING LADLE on a TROLLEY	**14**	B	A	W	P
8224	ROLLER CONVEYORS for Foundry Moulds	**14**	C	B	S	P
8226	FIRECLAY FURNACE-LID FRAME	**14**	B	A	W	O
8227	Avery PLATFORM SCALES	**14**	B	B	W	O
8228	Avery BENCH-TOP SCALES	**14**	B	B	W	O
8230	ALUMINIUM CASTINGS on Pallets	**14**	C	B	S	O
8231	NON-FERROUS FOUNDRY FURNACES	**14**	B	A	W	P
8233	FOUNDRY DRAWINGS	**14**	?	?	H	R
8005	PATTERNS STORED in Roof of Sand Shed	**15**	A	A	W	O
8005	STACKS of PATTERNS on Shelves	**16**	A	A	W	O
436	Wadkin WOOD MILL	**17**	A	A	W	O
436	Wadkin WOOD MILL - CUTTERS & TOOLS	**17**	A	A	W	O
865	Tauco PLANER / BUZZER	**17**	B	A	W	O
1080	Macson BAND-SAW	**17**	B	A	W	O
1609	Kitchen & Wade 2-inch PILLAR DRILL	**17**	A	A	W	O
1959	Pickles WOOD LATHE	**17**	B	A	W	O
1960	Wadkin WOOD LATHE	**17**	B	A	W	O
1961	Wadkin HEAVY DUTY (SLIDING GAP-BED) LATHE	**17**	A	A	W	O
1961	Wadkin HEAVY DUTY WOOD LATHE (Gap-Bed detail)	**17**	A	A	W	O
1976	Thomas White WOODWORKER'S TOOL GRINDER	**17**	B	A	W	O
2792	Bridgeport METAL MILL	**17**	C	B	W	R
3004	Sheraton METAL WORKING LATHE	**17**	C	B	W	O
8005	PATTERNS on STEPPED SHELVES on Mezzanine	**17**	A	A	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8005	STACK of WOODEN PATTERNS	17	B	A	S	R
8036	PATTERNMAKER'S WORKBENCH with VYCE etc.	17	A	A	W	R
8037	HAND TROLLEY with Rubber Tyred Wheels	17	B	B	W	O
8038	PATTERN RECORDS	17	A	A	A	R
8038	PATTERN RECORDS	17	A	A	A	R
8040	HEIGHT MARKER / SCRIBER & SURFACE PLATE	17	B	A	W	R
8041	LETTER & NUMBER PUNCHES	17	B	A	W	R
8026	TOOLS & DIES for Steam Hammer	19	A	A	W	R
8213	TRIMMING DIES for Forged Components	19	B	A	W	R
583	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
584	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
586	Worthington-Simpson 3-THROW HYDRAULIC PUMP	22	A	A	D	Y
589	Tannet Walker LOW-PRESSURE BLOWER	22	A	A	W	Y
1009	Alley & McClellan "Sentinel" AIR COMPRESSOR	22	A	A	W	Y
1009	B.T.H. CONTROL PANEL for Sentinel COMPRESSOR	22	A	A	W	Y
1197	Crossley Reavell AIR COMPRESSOR	22	A	A	W	Y
8068	RIVETED COMPRESSED AIR TANK	22	B	B	W	O
8069	CAST-IRON STEAM-PIPE BRACKETS	22	B		D	Y
8070	Dawn BENCH VYCE	22	C	B	W	Y
8071	Oerlikon 5-ton OVERHEAD TRAVELLING CRANE	22	B	A	D	Y
8071	Oerlikon 5-ton OVERHEAD TRAVELLING CRANE	22	B	A	D	Y
8072	WORKS MANAGER'S BOX No.3	22	A		D	O
8073	WAGR made LEATHER TOOL BAGS	22	B	B	D	O
8074	WAGR made GALVANISED-IRON RUBBISH BIN	22	A	A	D	R
8075	POWERHOUSE TOOL CUPBOARDS	22	A		S	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8076	INSTRUCTIONS for "Sentinel" COMPRESSOR	22	A	A	D	Y
8077	SPARE PRESSURE RELIEF (SAFETY) VALVE	22	A	A	D	R
8078	POWERHOUSE FOREMAN'S DESK	22	A		D	P
8079	SOUND-PROOFED TELEPHONE BOOTH	22	B		W	Y
8079	Telephone Booth detail - DOOR HANDLE	22	B		W	Y
8080	J.W.Benson WALL CLOCK	22	A		W	P
8081	John Brooks LARGE POST VYCE with STAND	22	A	A	W	P
8083	MISCELLANEOUS DISUSED MACHINERY	22			H	R
8086	TALL RIVETED AIR RECEIVER	22	A	A	W	Y
8087	WORKSHOP SIRENS	22	A	A	W	Y
8087	WORKSHOP SIREN HANDLES	22	A	A	W	Y
8159	WAGR made "St JOHN AMBULANCE" BOX	22	A	A	D	O
8250	PANEL for various PRESSURE GAUGES	22	A	A	D	Y
8257	SUB-FLOOR STRUCTURES - POWERHOUSE	22	B	B	D	Y
410	PANING DOWN MACHINE	23	A	A	W	R
411	Rhodes GUILLOTINE with Foot Treadle	23	A	A	W	R
415	SCREW or FLY PRESS (TIN PUNCH)	23	A	A	W	R
555	Buck & Hickman 20-inch 3-ROLL BENDING ROLLS	23	A	A	W	R
829	20-inch FOLDING MACHINE	23	A	A	W	R
831	30-inch 3-ROLL BENDING ROLLS	23	A	A	W	R
832	BEADING MACHINE	23	A	A	W	R
833	THICK-EDGE or TURN-UP MACHINE	23	A	A	W	R
834	SWAGING or BEADING MACHINE	23	B	A	W	R
836	SWAGING or BEADING MACHINE	23	A	A	W	R
838	36-inch FOLDING MACHINE	23	A	A	W	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
839	PANING DOWN MACHINE	23	A	A	W	R
841	TURN-UP or WIRING MACHINE	23	A	A	W	R
844	JENNY or BURRING (CREASING) MACHINE	23	A	A	W	R
868	Heine 6-ft GUILLOTINE	23	B	A	W	R
1354	Hercus HEAVY DUTY POST DRILL	23	B	A	W	R
1573	"Justice" CIRCLE CUTTING MACHINE	23	A	A	W	R
1574	John Heine PANING DOWN MACHINE	23	B	A	W	R
1578	"Justice" HEAVY DUTY JENNY (aka THICK EDGE)	23	A	A	W	R
1590	"Justice" MEDIUM DUTY TURN-UP or WIRING Mach.	23	B	A	W	R
2502	John Heine INCLINABLE FINNING PRESS	23	C	B	C	O
8016	COPPERSMITHS DIVIDERS & DEPTH SCRIBERS	23	A	A	W	R
8022	BURRING MACHINE or JENNY	23	C	C	O	
8023	COPPERSMITH'S SAMPLES on Display Board	23	A	A	D	R
8043	PUNCHING & STENCILLING MACHINE	23	B	B	W	O
8044	COPPERSMITH'S HAND TOOLS	23	A	A	W	R
8045	ROLLERS for BEADING & SWAGING MACHINES	23	A	A	W	R
8046	COPPERSMITH'S HAND TOOLS on Labelled Shelves	23	A	A	W	R
8047	COPPERSMITH'S WORKBENCH with Bench Plate	23	A	A	W	R
8048	WOODEN LOG with SHAPED END	23	A	A	W	R
8049	CONICAL CAST-IRON MANDREL	23	A	A	W	R
8050	3-roll BENDING ROLLS	23	A	A	W	R
8052	BRACKET for BENDING TAILS on PIPE JOINTS	23	B	B	W	R
8053	BRACKET with SMALL PIPE-BENDING ROLLS	23	B	B	W	R
8059	ROSIN POT HEATING STOVE & ROSIN (in drum)	23	A	A	W	P
8063	Avery PLATFORM SCALES	23	B	B	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8069	CAST-IRON STEAM-PIPE BRACKET	23	B		D	Y
8107	BOTTOM CLOSING MACHINE	23	A	A	W	R
8155	Former COAL & ASH CONVEYOR DOORWAY	23	B		D	Y
8155	RIVETED STEEL FRAME for Coal Bunkers	23	B		D	Y
8257	SUB-FLOOR STRUCTURES - BOILERHOUSE	23	B	B	D	Y
2524	PANEL WHEELING MACHINE	24	B	B	W	O
8060	Cast Steel SWAGING BLOCKS	24	A	A	W	R
8061	Blacksmiths FULLER or SWAGE HAMMERS	24	A	A	W	R
8062	Boilermakers FLANGING or DRAWING DIES	24	B	A	W	R
8249	"TIN" TOY TRAIN	24	B		D	R
400	Fielding & Platt HYDRAULIC BENDER	26	A	B	W	R
8053	SAFETY NOTICE - LEAD POISONING	26	A	A	D	O
8054	MOULDS for NON-FERROUS INGOT CASTING	26	B	A	W	R
8055	LADLES & POTS for NON-FERROUS CASTING	26	B	A	W	R
8056	Collection of TONGS for Non-Ferrous Casting	26	B	A	W	R
8057	STOCK SHEARS (TIN SNIPS)	26	A	A	W	R
8058	MOBILE TOOL-BOX & WORKBENCH	26	A	A	W	R
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
545	Fairbanks LOCOMOTIVE WEIGHBRIDGE	28	A	A	W	Y
8091	PAINTED TOOL CUPBOARD (Apprentice names)	29	B		D	O
8091	PAINTED TOOL CUPBOARD (with Loco numbers)	29	B		D	O
2735	Barnet DEAD WEIGHT TESTING EQUIPMENT	30	B		W	R
8017	JEWELLER'S PUNCH with FITTED BOX	30	B		D	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8018	"Timegrapher" WATCH & CLOCK CALIBRATOR	30	B		D	R
3252	"British Made" POST (or PILLAR) DRILL	31	A	A	D	R
8245	Canning AC-DC ROTARY CONVERTER & CONTROLS	31	B	B	D	R
550	Selig Sonnenthal SCREW-CUTTING LATHE	32	B	B	D	R
1543	Hercus 4-inch LATHE	32	B	A	W	R
3255	EMF MOBILE ELECTRIC WELDER	32	B	A	D	R
8147	OLD BOILER (possibly from a Steam Crane)	32	?	?	H	O
1111	Denham LATHE	33	B	B	W	O
8019	CRANE SKIP	33	A	A	W	O
8008	ELEVATED CIRCULAR RIVETED STEEL TANK	34	A	A	W	P
8020	Oerlikon 3-ton OVERHEAD TRAVELLING CRANE	43	A	A	W	Y
8020	HOOK detail from 3-ton Oerlikon CRANE	43	A	A	W	Y
8253	STEEL DOOR to MAIN STORE	43	B	B	P	Y
144	Asquith BOX TABLE for Asquith Radial Drill	45	B	B	C	O
152	Kendall & Gent PLANO-MILLING MACHINE	45	A	A	W	Y
153	Kendall & Gent PLANO-MILLING MACHINE	45	A	A	W	Y
172	Stirk PLANING MACHINE	45	A	A	W	Y
172	Stirk PLANING MACHINE	45	A	A	W	Y
174	CAST-IRON MARKING OUT TABLE	45	A	A	W	Y
174	SCRIBING TOOLS for MARKING-OUT TABLE	45	A	A	W	Y
194	Metropolitan-Vickers AC-DC ROTARY CONVERTER	45	A	A	W	O
386	Small BENCH GRINDER / PIN LATHE	45	A	A	W	P
1089	Webster Bennett DUPLEX BORING & TURNING MILL	45	A	A	W	O
1098	Cincinnati TOOL & CUTTER GRINDER	45	B		W	O
1120	Cincinnati MILLING MACHINE	45	B	A	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1200	Regal leBlond CENTRE LATHE	45	C	B	C	O
1224	Jones & Lamson THREAD GRINDING MACHINE	45	B	B	W	O
1249	Churchill UNIVERSAL GRINDER	45	C	B	W	O
1250	Churchill SURFACE or RING GRINDER	45	B	B	W	O
1251	Macson TOOL & CUTTER GRINDER	45	B	B	W	O
1258	"Doall" BANDSAW	45	B	B	C	O
1260	Macson SLOTTING MACHINE	45	B	B	W	O
1263	Avery HARDNESS TESTER TYPE 1410	45	B	A	W	O
1285	Cussons PROFILE PROJECTOR	45	A	A	W	R
1285	Cussons PROFILE PROJECTOR SCREEN	45	A	A	W	R
1285	SCRIBED THREAD-PROFILE TEMPLATES	45	A	A	W	R
1286	(Newall ?) LENGTH MEASURING MACHINE	45	A	A	D	O
1296	Dean Smith & Grace LATHE	45	B	B	S	P
1301	Brackenbury & Austin PLANER	45	B	B	W	Y
1301	Brackenbury & Austin PLANER	45	B	B	W	Y
1302	Butler SLOTTING MACHINE	45	A	A	W	P
1337	"FES" or "LNC" HORIZONTAL BORING MACHINE	45	A	A	W	Y
1337	BORING BARS for HORIZONTAL BORING MACHINE	45	A	A	W	O
1357	Churchill SURFACE GRINDER	45	B	B	W	O
1368	Small DUAL PEDESTAL GRINDER	45	C	B	S	O
1377	Asquith 5 ft 9 inch MOBILE RADIAL DRILL	45	A	A	W	O
1417	Webster & Bennett TWIN HEAD VERTICAL BORER	45	B	A	W	O
1424	Dean Smith & Grace GAP BED LATHE	45	B	A	S	O
1451	Ormerod SHAPER	45	B	A	W	O
1536	Snow SURFACE (RING) GRINDER	45	B	B	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1616	"Alba" SHAPER	45	B	A	W	O
1623	Winn SINGLE HEAD SCREW-CUTTING MACHINE	45	B	B	C	O
1624	Cincinnati "Hydrotel" VERTICAL MILLER	45	B	A	W	O
1625	Ward No.13 COMBINATION TURRET LATHE	45	A	A	W	O
1627	Snow PISTON RING SURFACE GRINDER	45	B	B	H	O
1686	Town 4-ft RADIAL DRILL	45	B	B	W	O
1687	Town 4-ft RADIAL DRILL	45	B	B	S	O
1688	Town 4-ft RADIAL DRILL	45	B	B	S	O
1689	Town 4-ft RADIAL DRILL	45	B	B	S	O
1693	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1694	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1695	Kitchen & Wade 6-ft RADIAL DRILL	45	B	B	S	O
1699	Henry Berry 400-ton HYDRAULIC WHEEL PRESS	45	A	A	W	Y
1699	Henry Berry 400-ton HYDRAULIC WHEEL PRESS	45	A	A	W	Y
1819	Archdale VERTICAL MILLING MACHINE	45	B	B	W	O
1820	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1824	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1825	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1828	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1834	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1835	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1837	Dean Smith & Grace MEDIUM-DUTY LATHE	45	B	B	S	O
1838	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1839	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1955	Kendall & Gent VERTICAL MILLER	45	B	B	S	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1957	Kendall & Gent VERTICAL MILLER	45	B	B	S	O
1980	Churchill DOUBLE RADIUS LINK BOLT GRINDER	45	B	A	W	P
1981	Parkson UNIVERSAL MILLING MACHINE	45	B	B	S	O
1984	Joshua Heap SCREWING MACHINE	45	B	B	W	O
2001	Macson AXLE LATHE	45	B	A	S	P
2002	Macson AXLE LATHE	45	B	A	S	P
2004	Macson AXLE LATHE	45	B	A	S	P
2014	Parkson UNIVERSAL MILLING MACHINE	45	C	C	O	
2041	Churchill LOCOMOTIVE AXLE JOURNAL GRINDER	45	A	A	W	P
2059	Kendall & Gent PLANO MILLER	45	B	B	W	O
2154	Cincinnati "Monoset" TOOL & CUTTER GRINDER	45	B	B	W	O
2191	Cincinnati TOOL & DIE MILLING MACHINE	45	B	B	W	O
2211	Churchill No.3 INTERNAL CYLINDER GRINDER	45	B	B	W	P
2221	Churchill HORN BLOCK GRINDING MACHINE	45	A	A	W	P
2267	Churchill CRANKSHAFT GRINDER	45	B	A	W	P
2268	Sunderland GEAR PLANER	45	B	B	W	O
2286	Newall LENGTH MEASURING MACHINE	45	B	A	W	O
2357	Societe Genevoise PROFILE PROJECTOR	45	B	A	W	O
2435	WAGR made BROACHING MACHINE	45	B	B	W	O
2435	BROACHING TOOLS for BROACHING MACHINE	45	B	B	W	O
2478	MFD-Dortmund AXLE BURNISHING LATHE	45	B	A	W	P
2731	Dean Smith & Grace CENTRE LATHE	45	C	B	S	O
3106	Hitachi Seiki WHEEL LATHE	45	C	A	W	P
3241	Wing CENTRES MACHINE	45	B	A	W	O
3305	Mori Seiki COMPUTER CONTROLLED LATHE	45	C	B	S	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8004	PERSONNEL DOCKETS & BOARDS (SHOP)	45	A	A	D	R
8029	LINESHAFT REMNANTS (Brackets)	45	A	A	W	Y
8029	LINESHAFT REMNANTS (Brick piers & arch)	45	A	A	D	Y
8029	LINESHAFT REMNANTS (Plummer Block)	45	A	A	D	Y
8065	WAGR made OIL BOTTLE	45	B	B	D	O
8093	TILTING BOX TABLE (possibly Kitchen & Wade)	45	B	A	W	O
8182	OFFICE DESK (in Toolroom Store)	45	C	B	W	O
8183	MICROMETERS & VERNIERS in Chest of Drawers	45	B	A	W	P
8184	CHEST OF DRAWERS (riveted steel drawers)	45	B		W	O
8185	HYDRAULIC HIGH-PRESSURE-WATER PIPELINE	45	A	A	D	Y
8186	CERAMIC INSULATORS & WOOD CABLE GUIDE	45	B	A	S	Y
8187	Small JIB CRANE (pivoted on a steel column)	45	B	B	S	O
8190	Clark Bunnet RIPPLE-IRON ROLLER SHUTTER	45	A	A	S	Y
8191	DUAL-GAUGE TURNTABLE & RAIL LINES	45	B	B	D	Y
8198	GO / NO-GO GAUGES & TEMPLATES	45	A	A	W	O
8198	TEMPLATES & PROFILE GAUGES	45	A	A	W	R
8198	TEMPLATES & PROFILE GAUGES	45	A	A	W	R
8199	Junghans TIMER	45	B	B	W	O
8200	INCH MICROMETERS & VERNIERS in cupboard	45	B	A	W	O
8201	Windley STRAIGHT EDGE (10 feet long)	45	B	A	W	O
8202	WAGR made DEMAGNETISER in WOODEN CASE	45	B	B	W	O
8203	CANE RUBBISH BASKET (Typical Example)	45	B		S	O
8205	WOODEN "PYRAMID" holding CHANGE GEARS	45	B	B	W	O
8206	Lancashire Dynamo Crypto ELECTRIC MOTOR	45	?	?	H	?
8207	Group of SMALL SCREW JACKS	45	B	A	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8208	STEEL SCRAP BIN	**45**	B	B	D	O
8209	CAST-IRON MARKING OUT TABLE	**45**	A	A	W	O
8214	RIVETED STEEL-RACK	**45**	A	A	W	O
8215	Group of SCREW JACKS for Carriages or Wagons	**45**	A	A	W	R
8215	Two-way ADJUSTABLE SCREW JACK	**45**	A	A	W	R
8232	"WHEEL SHOP" SIGN	**45**	B	A	D	P
8254	STEEL ROLLER OVER DOOR FRAME	**45**	B	B	S	Y
8255	INSPECTION PITS	**45**	A	A	W	Y
8256	SUPERVISOR'S OFFICE	**45**	A	A	W	Y
65	WAGR Riveted "CIRCULAR" FURNACE No.21	**46**	A	A	W	Y
70	WAGR Riveted "CIRCULAR" FURNACE No.70	**46**	A	A	W	Y
224	"Horsfal" NUT & BOLT FORGING MACHINE	**46**	A	A	W	Y
226	Tannet Walker 50-cwt ARCH STEAM HAMMER	**46**	A	A	W	Y
228	Massey single-side 25-cwt STEAM HAMMER	**46**	A	A	W	Y
238	Brett 40-cwt DROP HAMMER	**46**	A	A	W	Y
238	Brett Drop Hammer STEAM MOTOR	**46**	A	A	W	Y
242	Tomlinson Bros. hand operated FORGE CRANE	**46**	A	A	W	Y
243	Tomlinson Bros. hand operated FORGE CRANE	**46**	A	A	W	Y
247	Davy single-sided 7-cwt STEAM HAMMER & DIES	**46**	A	A	W	Y
249	Davy single-sided 10-cwt STEAM HAMMER	**46**	A	A	W	Y
508	Alldays & Onions CENTRIFUGAL FAN	**46**	A	A	W	Y
594	Ajax BOLT & DOG SPIKE FORGING MACHINE	**46**	A	A	W	Y
594	Ajax BOLT & DOG SPIKE FORGING MACHINE	**46**	A	A	W	Y
594	DIES for the Ajax DOG SPIKE MACHINE	**46**	A	A	W	O
597	WAGR FURNACE for Ajax Dog Spike Machine	**46**	A	A	W	Y

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
599	Thornley 6-SPINDLE NUT TAPPING MACHINE	**46**	A	A	W	Y
600	Thornley DOG SPIKE POINTING MACHINE	**46**	B	A	W	Y
601	McPherson DOG SPIKE FINNING PRESS	**46**	B	A	W	Y
603	Landis DOUBLE-HEAD SCREWING MACHINE	**46**	B	A	W	Y
604	McPherson DOG SPIKE FINNING PRESS	**46**	B	A	W	Y
652	Jessop & Appleby 30-cwt HAND CRANE	**46**	A	A	W	Y
653	Jessop & Appleby 30-cwt HAND CRANE	**46**	A	A	W	Y
660	ANNEALING FURNACE	**46**	B	A	W	Y
1083	Kitchen & Wade TOWER DRILL	**46**	A	A	W	Y
1690	Town 4-ft RADIAL DRILL	**46**	B	A	W	O
1845	Massey 10-cwt PNEUMATIC HAMMER	**46**	B	A	W	Y
1848	Covmac No.4 FORGING (HEADING) MACHINE	**46**	B	A	W	Y
1848	Covmac No.4 FORGING (HEADING) MACHINE	**46**	B	A	W	Y
1852	Massey 12.5-cwt DROP HAMMER	**46**	B	A	W	Y
1854	Massey 120-ton FINNING PRESS	**46**	B	A	W	Y
1913	Henry Berry SPRING BUCKLING PRESS	**46**	A	A	W	P
1913	FORMERS & DIES for Spring Buckling Press	**46**	A	A	W	O
1920	WAGR OIL FURNACE for Covmac Machine	**46**	B	A	W	Y
1974	Henry Berry SPRING TEST & SCRAGGING MACHINE	**46**	B	B	W	P
1975	H. Berry SPRING BUCKLING & STRIPPING Mach.	**46**	A	A	W	P
2016	Fairbank Brearley SPRING COILING MACHINE	**46**	A	A	W	P
2016	Fairbank Brearley SPRING COILER MANDRELS	**46**	A	A	W	O
2017	Fairbank Brearley SPRING TAPERING ROLL	**46**	A	A	W	P
2064	Massey 20-cwt FRICTION DROP HAMMER	**46**	B	A	C	Y
2065	Massey 200-ton FINNING PRESS	**46**	B	A	C	Y

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Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2196	Massey 15-cwt FRICTION DROP HAMMER	**46**	B	A	C	Y
2198	Massey 120-ton FINNING PRESS	**46**	B	A	C	Y
2200	Small FURNACE	**46**	C	A	W	P
2436	Hercus LATHE / SPRING COILING MACHINE	**46**	C	C	O	
3285	Young's 36-cwt DUAL-SPEED HAND WINCH	**46**	A	A	W	Y
3403	Fielding & Platt 30-cwt HAND CRANE	**46**	A	A	W	Y
3737	FURNACE for Massey 20-cwt Drop Hammer	**46**	C	A	W	Y
3742	Small FURNACE	**46**	C	A	W	Y
3743	Small FURNACE	**46**	C	A	W	Y
3745	Small FURNACE	**46**	C	A	W	Y
3746	Small FURNACE	**46**	C	A	W	Y
3751	Blacksmiths LARGE FURNACE	**46**	B	A	W	Y
3759	Blacksmiths LARGE FURNACE	**46**	B	A	W	Y
8013	Blacksmiths HAND SWAGING TOOLS	**46**	A	A	W	P
8013	Traditional BLACKSMITHS TONGS & DIES	**46**	A	A	W	P
8014	SPECIAL TROLLEY LINE for Dog Spikes	**46**	A	A	W	Y
8014	FLAT-BED STEEL TROLLEYS for Dog Spikes	**46**	A	A	W	P
8014	Bags of Finished DOG SPIKES	**46**	C	A	S	P
8014	Avery PLATFORM SCALES	**46**	B	A	W	P
8025	TWO HANGING SIGNS on BLACKSMITH SHOP	**46**	A	A	D	Y
8026	TOOLS & DIES for Steam Hammer	**46**	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	**46**	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	**46**	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	**46**	A	A	W	P
8026	TOOLS & DIES for Steam Hammer	**46**	A	A	W	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8027	CONICAL CAST-IRON MANDREL	46	A	A	W	R
8030	Small 4-wheeled HAND TROLLEY	46	C	A	W	P
8069	CAST-IRON STEAM-PIPE BRACKETS	46	B		D	Y
8089	MATERIALS STAND with RATCHET ADJUSTMENT	46	B	B	W	O
8101	Collection of RIVETS	46	A	A	D	O
8102	GAP RIVETER CRANE TOWER in Boiler Shop Roof	46	A	A	D	Y
8102	Oerlikon 15-ton OVERHEAD TRAVELLING CRANE	46	A	A	D	Y
8103	STEEL SIGN - Apprentice School	46	C	B	D	R
8105	SWAGING BLOCK & Blacksmiths TOOLS & STAND	46	A	A	W	P
8106	TROLLEY SUPPORT on RAILS	46	B	A	W	P
8108	PAIR of "WROUGHT IRON" GATES	46	B	B	D	Y
8109	Traditional FORGE, ANVIL & RACK of TONGS	46	A	A	W	Y
8110	Blacksmiths IRON WORK TABLE	46	A	A	W	P
8111	Rack of SPRING COILING MANDRELS	46	B	A	W	P
8111	SPRING COILING MANDREL - hand operated	46	B	A	W	P
8129	Ingersoll-Rand PNEUMATIC REAMERS	46	B	A	W	R
8130	PNEUMATIC RIVET GUN, PNEUMATIC DOLLY & DI	46	B	A	W	R
8131	PNEUMATIC RIVET BUSTER with PUNCH & CHISEL	46	B	A	W	R
8146	FURNACE No.374	46	C	A	W	P
8185	HYDRAULIC HIGH-PRESSURE-WATER PIPELINE	46	A	A	D	Y
8216	Marfleet & Weight SMALL FURNACES	46	C	C	O	
8243	LINESHAFT REMNANTS (Pulleys & Flat Belts)	46	A	A	W	Y
8251	CHIMNEY RECESS & UNDERFLOOR FLUES	46	B	B	D	Y
8262	EXPERIMENTAL TWISTED DOG SPIKES	46	B	B		
46	Kendall & Gent PIPE-CUTTING MACHINE	47	A	A	W	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
46	Kendall & Gent PIPE-CUTTING MACHINE	47	A	A	W	R
307	Robinson of Rochdale PEDESTAL GRINDER	47	A	A	W	P
323	Robinson of Rochdale CIRCULAR SAW	47	A	A	W	P
325	J.A. Fay TENONING MACHINE	47	A	A	W	P
327	J.A. Fay 4-SPINDLE BORING MACHINE	47	A	A	W	P
327	RAIL TROLLEYS for J.A. Fay 4-Spindle BORER	47	A	A	W	P
327	CUPBOARD of DRILL BITS for J.A. Fay BORER	47	A	A	W	P
329	J.A. Fay COLUMN FRET SAW (or JIGSAW)	47	A	A	W	P
343	"Stuart Bell" MOTORISED BAND-SAW FILER	47	A	A	W	P
352	J.A. Fay & Egan DISC / SPINDLE SANDER	47	A	A	W	P
1015	Robinson of Rochdale 4-SIDE PLANER / MOULDER	47	A	A	W	P
1015	Robinson PLANER / MOULDER CUTTERS	47	A	A	W	P
1019	Sturtevant CENTRIFUGAL DRIVE FAN & MOTOR	47	A	A	W	P
1019	Sturtevant FAN CUPBOARD	47	B	A	W	Y
1021	Robinson of Rochdale CUTTER GRINDER	47	A	A	W	P
1022	Sturtevant CENTRIFUGAL DRIVE FAN & MOTOR	47	A	A	W	P
1062	Robinson of Rochdale PLANER & THICKNESSER	47	A	A	W	P
1141	"Remo" or "Goodall" PLANER & SURFACER	47	B	A	W	P
1161	Wadkin SAW FILING & SETTING MACHINE	47	A	A	W	P
1168	Kitchen & Wade 5ft RADIAL DRILL	47	B	B	W	O
1169	Wadkin WOOD LATHE	47	B	A	W	P
1216	Macson 2-SPINDLE MOULDER & SHAPER	47	B	A	W	P
1497	Martin MOBILE ELECTRIC RIVET HEATER	47	A	A	W	R
1704	Tangye SPACE HEATING STOVE	47	B	B	S	O
1936	WAGR made 8-HEAD DRILLING MACHINE	47	B	B	W	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1958	Joshua Heap SCREWING MACHINE	47	B	B	W	O
1965	Sturtevant DUST EXTRACTION FAN	47	A	A	W	P
2035	White "Faskut" POWER FEED CIRCULAR SAW	47	B	B	W	P
2272	BUTT WELDER for BAND-SAW BLADES	47	B	A	W	P
2277	Wadkin TENONING MACHINE	47	C	B	C	O
2278	Wadkin 2-spindle MOULDING & SHAPING MACHINE	47	B	B	C	O
2278	Wadkin 2-spindle MOULDER, BITS & TOOLS	47	B	B	C	O
2279	Wadkin WOODMILL	47	B	B	C	O
2280	Wadkin BANDSAW	47	B	B	C	O
2282	Wadkin SURFACE GRINDER	47	B	A	W	P
2283	Wadkin TOOL & CUTTER GRINDER	47	B	A	W	P
2323	Pickles-Ransome HORIZONTAL MORTICING M/C	47	B	A	W	P
2323	Pickles-Ransome MORTICING MACHINE SPACERS	47	B	A	W	P
2323	Pickles-Ransome MORTICING MACHINE DRILLS	47	B	A	W	P
2324	White VERTICAL MORTICING MACHINE	47	B	A	W	P
2333	Robinson of Rochdale PLANER	47	B	B	C	O
2334	Gill Bros. ROUNDING or DOWELLING MACHINE	47	B	A	W	P
2343	Pickles-Ransome 4-SIDE PLANER / MOULDER	47	B	B	C	O
2343	Pickles-Ransome PLANER/MOULDER CUTTERS	47	B	B	C	O
2344	Hebco DUAL WHEEL PEDESTAL GRINDER	47	C	C	W	P
2358	White 5-WHEEL GRINDER for TOOL SHARPENING	47	B	A	W	P
2362	Pickles TENON MACHINE	47	C	C	C	O
2364	Stenner CIRCULAR SAW	47	C	C	C	O
2791	Loroch SAW SETTING & SHARPENING MACHINE	47	C	A	W	P
3069	Lotze GULLETING MACHINE	47	C	A	W	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
3095	S.C.M. PLYWOOD SAW	47	C	C	C	O
3096	Mida DOVETAIL CUTTER	47	C	C	W	P
3097	Saturn TOOL & CUTTER GRINDER	47	C	B	C	O
3454	G.M.F. GRINDER	47	C	B	C	O
3455	Foley T.C. TIPPED SAW-BLADE SETTER	47	C	B	C	O
3594	MOTORISED TRICYCLE	47	B	B	S	R
8011	Mather & Platt / Grinell SPRINKLER SYSTEM	47	B	A	D	P
8012	HAND TROLLEY (on Narrow-gauge Trolley Line)	47	A	A	W	O
8012	TROLLEY- LINE TURNTABLE	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8021	UNDER-FLOOR DUST EXTRACTION SYSTEM	47	A	A	W	Y
8029	LINESHAFT REMNANTS (Bolt Holes & Bracket)	47	B	B	D	Y
8029	LINESHAFT REMNANTS (Bolt Holes in channel)	47	B	B	D	Y
8090	SAWDUST COLLECTION "CYCLONES"	47	B	B	W	O
8092	3-LEGGED CAST-IRON STAND	47			H	O
8094	FITTER'S WORKBENCH & VYCE	47	A	A	D	O
8095	SPECIAL CUPBOARD for WOOD-WORKING TOOLS	47	A	A	S	P
8096	Mastabar DOUBLE LEVER SPEED LACER	47	B	A	W	O
8097	CARPENTER'S CLAMPS	47	A	A	W	P
8098	ADJUSTABLE-HEIGHT SUPPORT-ROLLER	47	A	A	W	P
8099	TYPICAL WOOD MILL WORKBENCH	47	A	A	S	P
8100	MIDLAND WORKSHOPS TABLE MODEL	47	A	A	D	R
8135	Phoenix SAW-TOOTH SETTER	47	A	A	W	P

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8136	HAND-OPERATED SAW-TOOTH SETTER	47	A	A	W	P
8137	WOODEN SAW VYCE (SHORT)	47	A	A	W	P
8138	WOODEN SAW VYCE (LONG)	47	A	A	W	P
8139	LONG BALANCE ARM	47	?	?	H	P
8140	Saw Doctor's EQUIPMENT on SMALL WORKBENCH	47	A	A	W	P
8141	SHAPER BLADES in FITTED WOODEN CUPBOARD	47	A	A	W	P
8142	SET of ROLLERS used to hold Band-Saw Blades	47	B	A	W	Y
8142	FLOOR STUDS for Measuring Band-Saw Blades	47	B	A	W	Y
8143	STEEL BLOCK SAW-BLADE STRAIGHTENER	47	A	A	W	P
8145	HAND PALLETS or STRETCHERS	47	A	A	S	P
8148	OLD OFFICE PAPER PUNCH	47	A		D	R
8149	WOODWORKING POSTERS	47	A	A	D	P
8149	WOODWORKING POSTERS	47	A	A	D	P
8186	CERAMIC INSULATORS for 1904 Crane Power Wires	47	B		D	Y
8190	Kinnear STEEL-SLAT ROLLER SHUTTER DOOR	47	A	A	S	Y
8247	SAW-DOCTOR'S LOG BOOK (seen in Cupboard)	47	A	A	A	R
251	Henry Berry BENDING & STRAIGHTENING PRESS	52	A	A	W	P
273	Kendall & Gent PLATE EDGE PLANER	52	A	A	W	Y
273	Kendall & Gent PLATE EDGE PLANER	52	A	A	W	Y
275	Smith Bros. 4-roll PLATE BENDING ROLLS	52	A	A	W	Y
279	Asquith RADIAL DRILL	52	A	A	W	O
616	WAGR PLATE FURNACE for Hydraulic Press	52	A	A	W	Y
1005	Henry Berry VERTICAL HYDRAULIC PRESS	52	A	A	W	P
1023	Kitchen & Wade 6ft RADIAL DRILL	52	A	A	W	O
1090	"Mammoth" FLAT-BAR BENDER	52	B	A	W	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1207	Town 4-ft RADIAL DRILL	52	B	B	W	P
1642	Tate 6-ft HAND CURVING ROLLS	52	C	B	W	R
2006	Fielding 1000-ton HYDRAULIC FLANGING PRESS	52	A	A	W	Y
2007	J. Booth 1.5-ton TRAVELLING FURNACE CHARGER	52	B	A	W	Y
2075	LARGE PLATE FURNACE for the 1000-ton Press	52	B	A	W	Y
2201	James Bennie 3-roll PLATE BENDING ROLLS	52	B	A	W	Y
8028	CIRCULAR CAST-IRON FORMING TABLE	52	A	A	W	Y
8033	SUMP PUMP, PNEUMATICALLY POWERED	52	B	B	D	P
8034	TEMPLATES	52	B	B	S	R
8114	Vickers-Hoskins 10-ton O'HEAD TRAV. CRANE	52	B	B	C	Y
8115	Boilermakers HAND-WORKING EQUIPMENT GROUP	52	A	A	W	Y
8116	Vickers-Hoskins 5-ton O'HEAD TRAVELLING CRANE	52	B	B	C	Y
8132	Boilermaker/Blacksmith HAND TOOLS COLLECTION	52	A	A	D	R
8244	Large CAST-IRON MARKING-OUT TABLE	52	A	A	W	Y
456	J.Buckton 40-ton CHAIN & COMPRESSION TESTER	54	A	A	W	O
456	J.Buckton 40-ton CHAIN & COMPRESSION TESTER	54	A	A	W	O
1289	Firth HARDOMETER	54	A	A	W	O
1290	WAGR Budenberg PRESSURE GAUGE TESTER	54	A	A	W	O
1539	Avery ROCKWELL HARDNESS TESTER	54	B	A	W	O
1619	Avery UNIVERSAL TESTING MACHINE	54	B	A	W	O
2783	Avery IZOD (IMPACT) TESTER	54	C	A	W	O
2783	GO / NO-GO GAUGES for Avery (IZOD) TESTER	54	C	A	W	O
3179	Avery-Denison UNIVERSAL TESTER	54	C	B	C	O
8025	TEST ROOM WALL SIGN	54	B	B	D	Y
8117	Hounsfield EXTENSOMETER	54	B	A	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8118	0-100 DUROMETER TESTER	54	B	A	W	O
8119	Pulsometer Co. SMALL MANUAL PUMP	54			H	O
8120	Hounsfield TENSOMETER	54	B	A	W	O
8121	INSTRUMENTS & GAUGES in Chest of Drawers	54	B	A	W	O
8122	Hewlett Packard CALCULATOR Model 46	54	B	B	D	O
8123	"Victoria" OVERHEAD TRAVELLING CRANE	54	A	A	W	P
8124	GLASS FRONTED CABINET & CONTENTS	54	A	A	D	R
8125	Avery BRASS WEIGHTS & fitted WOOD TRUNK	54	A	A	D	R
8125	Avery 25kg BRASS WEIGHT (largest of the set)	54	A	A	D	R
8126	Set of STANDARD CALIBRATION DIPSTICKS	54	C	C	C	O
8127	Ashcroft STEAM ENGINE INDICATOR	54	A	A	D	O
8128	Dennert & Pape PLANIMETER	54			H	O
842	BEADING or SWAGING MACHINE	57	A	A	W	R
1519	John Heine BURRING MACHINE or JENNY	57	B	A	W	R
1990	WAGR made 3-roll 6-ft BENDING ROLLS	57	A	A	W	R
2483	John Heine 3-ft MANUAL FOLDER Model 25H	57	B	B	W	R
8042	McPherson's BEADING or SWAGING MACHINE	57	B	B	W	R
8044	COPPERSMITH'S HAND TOOLS	57	A	A	W	R
8044	COPPERSMITH'S HAND TOOLS and WORKBENCH	57	A	A	W	R
8197	3-ft 3-ROLL BENDING ROLLS	57	B	A	W	R
1013	Redman RAIL PLANER	59	A	A	W	O
1013	Shelves of CUTTING TOOLS for Redman PLANER	59	A	A	W	O
1013	LDC AC-DC ROTARY CONVERTER & DC MOTOR	59	A	A	W	O
1013	L.D.C. CONTROL CABINET for Redman PLANER	59	A	A	W	O
1177	"Hosco" UNIVERSAL MILLING MACHINE & TOOLS	59	A	A	W	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
1177	"Hosco" MILLING MACHINE - CUTTER BOARD	59	A	A	W	O
1201	Hendy CENTRE LATHE	59	C	B	C	O
1235	Macbro PEDESTAL GRINDER	59	B	B	W	O
1262	Hercus POWER HACKSAW	59	B	A	W	O
1281	Dean Smith & Grace LATHE	59	B	B	S	O
1299	Dean Smith & Grace LATHE	59	B	B	S	O
1338	McLean PEDESTAL GRINDER	59	B	B	W	O
1362	Asquith 4 ft 6 inch RADIAL DRILL	59	B	B	W	O
1362	PAIR of TROLLEYS on RAILS for Aquith DRILL	59	B	B	W	O
1537	Snow SURFACE (RING) GRINDER	59	C	C	W	O
1927	Town 4-ft RADIAL DRILL	59	B	B	S	O
2009	Butler SLOTTING MACHINE	59	B	B	W	O
2036	Stirk "Hiloplane" RAIL PLANER	59	B	B	W	O
2036	Brookhurst CONTROL CABINET for Stirk PLANER	59	B	B	W	O
2203	Butler PRECISION TOOLROOM SLOTTER	59	B	B	W	O
2543	Dean Smith & Grace CENTRE LATHE	59	C	B	S	O
2574	Finlay HYDRAULIC RAIL BENDING PRESS	59	C	B	C	O
8013	Traditional BLACKSMITHS TONGS & ANVIL	59	B	A	W	R
8027	CONICAL CAST-IRON MANDREL	59	A	A	W	R
8178	WOODEN MOBILE TOOL-BOX & WORKBENCH	59	B	A	W	O
8179	Small JIB CRANE (SWL 50kg)	59	B	B	S	O
8180	Large HEXAGONAL NUTS (unidentified)	59	?	?	H	R
8181	TWIN JIB CRANES (on a shared mast)	59	B	B	S	O
8192	MANUAL SCREW-TYPE BENDER or CLAMP	59	B	B	D	O
8193	UNIDENTIFIED TRACK-WORK AIDS	59			H	O

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8194	CAST COMPONENTS of RAIL CROSSINGS	59	B	B	S	O
8195	TEMPLATES & GAUGES for Trackwork Components	59	A	A	W	O
8196	300kg & 200kg JIB CRANES	59	B	B	S	O
8241	Blacksmiths SQUARE CAST-IRON WORK TABLE	59	A	A	W	R
1017	Singer SEWING MACHINE	64	A	A	W	R
1461	Singer SEWING MACHINE	64	A	A	W	R
3094	WAGR made EYELETING MACHINE	64	C	B	W	R
3185	Singer SEWING MACHINE	64	A	A	W	R
8082	WORLD WAR 1 HONOUR BOARD (Boiler Shop Roll)	64	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (Mount for Photos)	64	A	A	D	R
8082	WORLD WAR 1 HONOUR BOARD (Traffic Branch ?)	64	A	A	D	R
8156	PAINT PIGMENT MILL	64	A	A	D	O
8157	"TIN" CANISTER for VARNISH BRUSHES	64	A	A	D	O
8157	PAINT STORE HATCH	64			H	Y
8157	PAINTING EQUIPMENT, BRUSHES, CANS etc.	64	B	B	D	O
8158	COLLECTION of "POUNCERS"	64	A	A	A	R
8158	COLLECTION of SIGNS & BADGES	64	B	A	D	R
8158	SAMPLE PAINTED TRAIN SIGN	64	B	A	D	O
8159	WAGR made METAL BOXES	64	A	A	D	R
827	Jones Burton HAND OPERATED GUILLOTINE	66	B	A	W	R
1516	"Carr Fastener" EYELETING MACHINE	66	C	B	W	R
1865	SINGER No.2 SEWING MACHINE	66	C	B	W	R
2061	Churchill CAR & WAGON AXLE JOURNAL GRINDER	66	A	A	W	R
2061	COMPONENTS of C & W AXLE JOURNAL GRINDER	66	A	A	W	R
2061	FACEPLATE for C & W AXLE JOURNAL GRINDER	66	A	A	W	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
2061	WHEEL-SET LIFTER for JOURNAL GRINDER	66	A	A	W	R
2061	West CONTROL CABINET for JOURNAL GRINDER	66	A	A	W	R
3221	WAGR made BOBBIN WINDER	66	C	B	W	R
8161	TARPAULIN TABLE & STRETCHING BARS	66	B	B	D	R
8162	TARPAULIN WORK ORDER BOARD	66	A	A	D	R
8163	WAGR made (Kerosene Can) CHEST OF DRAWERS	66	B	B	D	R
8164	OLD POST VYCE (adapted for rope work)	66	A	A	W	R
8165	TRANSPORTING TRUCK (or PLATFORM TRUCK)	66	A	A	W	R
8166	SET of DRYING LINES for TARPAULINS	66	C	B	O	
8167	SEWING BENCH with WOODEN ROLLERS	66	B	A	S	R
8246	SINGER (?) BOBBIN WINDER	66	A	A	D	R
1850	Covmac FORGING (HEADING) MACHINE (3.5in)	74	C	C	D	R
2504	Lindemann of Dusseldorf SHEARING MACHINE	74	B	A	W	R
2718	FIBRE-GLASS CHOPPER GUN	74	C	C		
2800	Robinson FIBRE-GLASS RESIN/CUTTER	74	C	C		
3113	PUNCH & SHEAR MACHINE	74	A	A	W	R
3120	Mark-1 FIBRE-GLASS GEL-COATER	74	C	C		
8112	Thomas Smith of Rodley 3.5-ton STEAM CRANE	74	A	A	D	R
8112	Thomas Smith of Rodley 3.5-ton STEAM CRANE	74	A	A	D	R
8112	Thomas Smith of Rodley STEAM CRANE JIB	74	A	A	D	R
8150	Fielding & Platt 3-THROW HYDRAULIC PUMP	74	B	A	D	R
8151	WOODEN BRAKE-VAN or GUARD'S VAN	74	B	A	D	R
8152	Railway Signal Co. STAFF SAFE-WORKING DEVICE	74	A	A	S	R
8153	LOCOMOTIVE BOILER	74	A	A	D	R
8154	McKenzie & Holland SETS of POINTS LEVERS	74	A	A	D	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8031	DENTIST'S CHAIR	**81**	A	A	D	O
2267	RECTIFIER TUBE for CRANKSHAFT GRINDER	**82**	B	A	W	R
8084	OLD ELECTRICAL METERS	**82**	A	A	D	O
8085	WALL CLOCK	**82**	B		O	R
8113	CIRCUIT BREAKER CUBICLES	**82**	C		S	Y
585	Worthington-Simpson 3-THROW HYDRAULIC PUMP	**84**	A	A	W	Y
586	PARTS from Worthington-Simpson PUMP No.586	**84**	A	A	D	Y
8032	CAST-IRON WATER TANK (water hydraulic system)	**84**	B	A	W	Y
8065	WAGR made OILCANS & OIL BOTTLE	**84**	A	A	D	R
248	Davy single-sided 7-cwt STEAM HAMMER	**90**	C	B	D	R
248	BASEPLATES for 7-cwt Davy Steam Hammer	**90**	C	B	D	R
1844	Massey 10-cwt PNEUMATIC HAMMER	**90**	C	B	D	R
1975	SPARE YOKE for H.Berry Spring Buckling Mach.	**90**	A	A	W	R
2006	DIES & COMPONENTS for Fielding 1000-ton Press	**90**	B	A	W	R
2076	Fielding & Platt HYDRAULIC ACCUMULATOR	**90**	A	A	W	Y
8002	PIG-IRON INGOT	**90**	A	A	D	R
8010	PAINT TEST SAMPLES	**90**	B	A	W	R
8024	Hardy's CHAIN & WIRE-ROPE CUTTER	**90**	A	A	W	R
8026	TOOLS & DIES for Steam Hammer	**90**	A	A	W	R
8035	SPECIAL ANVILS with Flat Top & 2 Square Holes	**90**	A	A	D	R
8066	SQUARE SECTION CAST-IRON FENCE POST	**90**	A	A	D	Y
8188	Pair of RIVETED COMPRESSED AIR RECEIVERS	**90**	B	A	W	O
8210	Pooley WEIGHBRIDGE	**90**	B	B	D	R
8210	Pooley WEIGHBRIDGE	**90**	B	B	D	R
8211	2 CAST-IRON MACHINE TOOL TABLES	**90**			H	R

SUMMARY OF ITEMS IN INVENTORY SORTED by LOCATION (Site No.)

Plant No.	DESCRIPTION	Site No.	Indiv. Signif.	Group Signif.	Keep for?	Keep in Situ?
8211	Lancashire Dynamo Crypto ELECTRIC MOTOR	**90**	C	B	D	R
8215	Fixed Height CAST-IRON STANDS	**90**	A	A	W	R
8248	BUCKLED LEAF SPRINGS	**90**	B	A	D	R
8252	HOT & COLD WELLS (CIRCULATING TANK)	**90**	B	B	P	Y
8259	KNOCK-OUT TABLE (Large) for Foundry Castings	**90**	A	A	W	R
8259	KNOCK-OUT TABLE (Small) for Foundry Castings	**90**	A	A	W	R
8260	STEEL TYRES FOR CAR & WAGON WHEELS	**90**	A	A	D	R
8261	RAIL TRACKS and SWITCH POINTS in Yard	**90**	A		W	F
8258	COAL LOADER CRANE RAILS	**92**	B	B	D	Y
8007	SQUARE CAST-IRON TANK - Interior Detail	**93**	A	A	W	O
8006	2 SEPTIC-SYSTEM AERATION ROCKPILES	**94**	A	A	D	Y
8006	Detail of SEPTIC-SYSTEM AERATION ROCKPILE	**94**	A	A	D	Y
8006	Detail of SEPTIC SYSTEM AERATION ROCKPILE	**94**	A	A	D	Y
1105	Craven CRANKPIN QUARTERING MACHINE	**95**	A	A	W	R
8168	Thomas Smith of Rodley 3-ton STEAM CRANE	**95**	A	A	D	R
8168	Thomas Smith 3-ton STEAM CRANE (nameplate)	**95**	A	A	D	R
8204	Vickers Hoskins OVERHEAD TRAVELLING GANTRY	**98**	B	B	C	Y

8. KEY to SIGNIFICANCE CODES

LEVELS OF SIGNIFICANCE

The heritage or cultural significance of the Workshops machinery and plant, and other artefacts, have been assessed in relation that found in other major historical workshops, especially railway workshops, within Australia, USA and UK. This has led to the general conclusion that the Midland Workshops has one of the most comprehensive and important collections of historical railway engineering workshop equipment in Australia, and one of the most important in the English-speaking world. Consequently, a large number of items of plant have been assessed as having high or very high significance, and have been recommended for conservation as individual items and particularly as integrated trade groups.

The level of significance of each item in the inventory is noted as being at level A, B or C:

A VERY HIGH SIGNIFICANCE

B HIGH SIGNIFICANCE

C MODERATE SIGNIFICANCE.

The significance of the inventory items has been assessed on two bases; firstly their INDIVIDUAL SIGNIFICANCE as individual machines or artefacts, and secondly their GROUP SIGNIFICANCE as part of a trade-related group (eg. blacksmithing). The group significance reflects the contribution of the item to the completeness and interpretative (display) value of the group, and can be higher than its value as an individual item (in the same way that a set of stamps, or the stamp which completes a set, will be valued more highly than the individual stamp(s) considered in isolation).

Items considered to be of SLIGHT SIGNIFICANCE (D) , or which DETRACT FROM SIGNIFICANCE (E) have not been included in this Inventory.

9. KEY to CONSERVATION POLICY CODES

The detailed Inventory of Plant (Volumes 2 & 3) gives recommendations as to whether or not each item should be kept, the main purpose for which it should be kept, and whether it needs to be kept in situ. Summarised lists of inventory items relevant to each of the various Plant Groups are given in Section 6, and another summarised list sorted by location is given in Section 7. In these summarised inventory lists the recommendations are indicated by a single-letter code in two columns headed "Keep for ?" and "Keep in Situ ?", as noted below.

RECOMMENDATIONS : (KEEP FOR ?)

A KEEP FOR ARCHIVES
(ie. documents, photographs etc.)

C KEEP FOR COMMERCIAL USE & VIABILITY
(rather than for heritage values).

D KEEP FOR DISPLAY
(as a non-working museum exhibit, or as a static part of a working museum set-up).

H HOLD
(pending further information and assessment).

O OPTIONAL
(Conservation should be considered, but is not essential).

S KEEP SAMPLES
(for use in a working museum, or as a static museum display).

W KEEP FOR WORKING MUSEUM
(including the options of commercial operation or static display).

RECOMMENDATIONS : (KEEP IN SITU ?)

Y YES - KEEP IN SITU FOR HERITAGE REASONS
(to conserve links with traditional place of use or with companion equipment)

P PREFERABLY KEEP IN SITU
(relocation elsewhere on site is tolerable., but involves some disadvantage)

O OPTIONAL
(Can be moved elsewhere on site without affecting significance or museum value.)

F FIXED
(Leave in situ for practical reasons, as relocation would be difficult and expensive.)

R RELOCATION RECOMMENDED
(to a secure location on site, or - for documents - to an archival repository.)